Annual Report 2013 – 2014

INSTITUTE OF
Visual Computing

Hochschule Bonn-Rhein-Sieg
University of Applied Sciences

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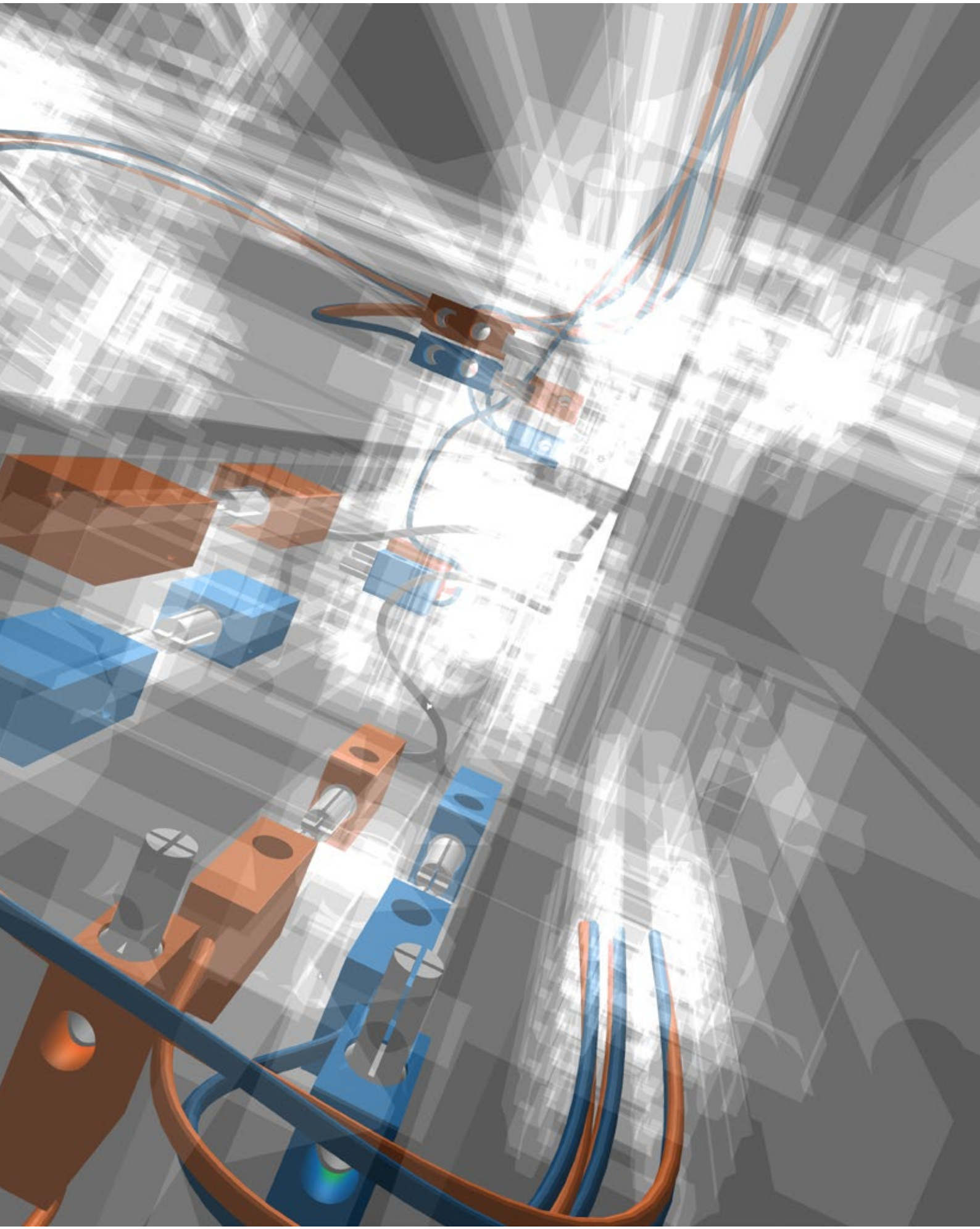


Contents

Foreword

We are pleased to present the second bi-annual report of the Institute of Visual Computing (IVC), covering the years 2013 and 2014. By coincidence, the German federal government dedicated the Year of Science 2014 to the Year of the Digital Society, a society in which Visual Computing plays a vital role. Visualisation is widely considered the key component in accessing, grasping, and interacting with digital data, media, and digital content because a large proportion of the information and knowledge currently available is represented, transferred, and published digitally. We therefore remain confident that the founding of the Institute of Visual Computing in 2011 was a forward-thinking decision and that we are contributing to society in the right place at the right time.

The last two years have been quite work-intensive and challenging. New members have been recruited, and experienced members have moved on to continue their careers in industry or at other research institutions, with one of our former members becoming full professor at another University of Applied Sciences. As a university body, we consider ourselves to be part of the scientific education circle, and we are thus prepared and even expect a frequent turnover among our scientific personnel. However, we are also pleased to continue working with our dedicated, focused, and experienced scientific staff and students. They are maintaining and developing the knowledge and experience at IVC, and we are extremely proud of all the grants, awards, and scholarships they received in the last two years; for more details, the reader is referred to "Awards" (page 33).

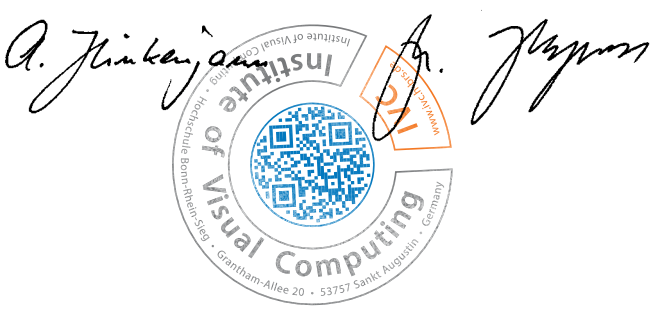
Moreover, the scientific output measured in publications and scientific contributions has increased by more than 50% in comparison to the figures from our previous bi-annual period. This shows remarkably the development IVC has undergone two years after its foundation as well as its increase in performance. In line with this development, the PhD student body at the IVC has been extended to seven internal and six external PhD students, demonstrating that the IVC is investing in its future, both as a scientific institute and as a centre of training for highly skilled researchers. With these steps, we are convinced that we have taken appropriate action to further the development and prosperity of IVC.

One of the highlights in 2014 was the grand opening of the large, ultra-high resolution display wall HORNET. It is a new addition to the visualisation equipment IVC is proud to operate. It is a unique selling point for IVC and has attracted widespread attention from the start. About 60 attendees from academia and industry witnessed the opening ceremony and first demonstrations of its breath-taking 72 megapixel visualisations.

The directors of the IVC wish to sincerely thank all national and international research and development partners from academia and industry. In the last two years, we were able to raise and increase third-party funding from the German federal government (BMBF, BMWi) and the European Commission. In addition, two new BMBF-funded projects, OLIVE and SkaSim, and two funded projects in perception research together with our Canadian partners, PUG Study I and II, extended the number of collaborative projects at IVC. The project MATEDIS received funding towards the end of the bi-annual reporting period and is contributing to the outstanding IVC record in collaborations with industrial partners within the Central Innovation Programme for Small and Medium-Sized Enterprise framework; for more details the reader is referred to the "Research Projects" (pages 18-25).

We understand that the presented bi-annual IVC report for the years 2013/2014 cannot reflect all contributions and special personal and general achievements made by IVC members in the last two years, but we have tried our best to provide a comprehensive inside view and would like to wish you an informative and enjoyable read.

Best regards,
André Hinkenjann Rainer Herpers



The field of Visual Computing covers a wide range of applications, generally related to computer environments with a visual paradigm that enable interaction and control. For us, Visual Computing encompasses the generation and analysis of imagery, as well as intuitive interaction with it.

Visual computing includes virtual, augmented and mixed reality as well as computer graphics, computer vision and similar fields. Technologies from these areas can open completely new perspectives in terms of analysis, creativity, interaction, decision-making and manufacturing in many industrial, research, education and training sectors.

Immersive Visualisation Laboratory

The Immersive Visualisation Lab is a unique visualisation facility, available to IVC and its partners in industry and academia. It hosts world-class interactive environments, such as a high-resolution stereo display wall with an optical tracking system and a three display high-end bicycle simulator. In addition it is home of the HORNET environment, an ultra-high resolution 72 megapixel tiled display with a large GPU cluster connected by 60 Gbit/s fibre cable. HORNET is equipped with a large scale leading edge optical tracking system and an accompanying audio system. The Immersive Visualisation Lab has enough space to allow large groups of scientists to use different facilities at once or discuss scientific results in groups in front of the HORNET display. Currently the high-end visualisation systems of the Immersive Visualisation Lab are used in projects with industry as well as for basic PhD research. This includes interaction in distributed large, collaborative environments as well as efficient high quality rendering approaches for large ultra-high resolution displays.

3D Interaction for Performance and User Experience

Within IVC, interaction is one of the prime research areas. We are predominantly concerned with spatial interaction, exploring 3D user interfaces for augmented and virtual reality systems. In this context, human factor plays a key role. Our goal is to create a deep understanding of the human sensorimotor system and its effects on designing novel and high quality interfaces. As such, we analyse human perceptual and control issues and their underlying neurological mechanisms, design interfaces in an experimental manner, and validate the created interfaces in both controlled laboratory settings and actual work environments. In particular, we look into the possibilities of multisensory interfaces. This process occurs in a multi-disciplinary manner, integrating disciplines such as design, computer science, and psychology.

We design interfaces for various domains and purposes and apply a methodology that emphasises three key user aspects. First of all, we target performance in the domain of perceptually, cognitively, or physically demanding environments. We aim at creating a better understanding of factors that affect interaction in these environments by analysing issues such as cognitive load, attention, and the processing of multi-sensory and heterogeneous information sources. At a deeper level of analysis, we look for impact on user behaviour and identify influences such as display technology, multi-user setups, and virtual reality environments that can change how users decide and act upon a system. Lastly, we study the emotional feelings of users and collect affective data, allowing us to shape the overall experience, especially considering the motivation and personal involvement of users.

This comprehensive understanding is applied to optimise system and user efficiency, e.g. by improving current techniques or by designing completely novel systems. We explore the potential of the human sensorimotor system to create vivid, multisensory and potentially full-body interfaces. The design is driven by creativity and taking unconventional approaches. Application domains include industrial production, medical systems, and educational training, and extend towards entertainment technology and immersive game experiences.

Rendering and Visualisation

Over the years, IVC members have done numerous research and development projects in the areas of computer graphics, interactive global illumination, parallel rendering, and scientific visualisation. Many third-party funded projects were conducted and many software systems have been developed. We do efficient parallel computer graphics, that enable interactive global illumination in the design review and evaluation of the interior design of new buildings. For the recent project IVAB, we developed SPARK, a GPU-based implementation of the path tracing algorithm. Together with GriP, a graph-based image post-processing middleware, we can now do physically based rendering of complex scenes at interactive framerates. This work is not only supported by project funding but also by a PhD thesis of Thorsten Roth. In the ongoing project MATEDIS, we extend this idea and include measured material properties into the rendering system. Together with partners from academia and industry we develop a compact measuring device and a workflow to integrate measured material appearance into realistic rendering environments. For several years, we have been focussing on visualisation of very large scenes, such as city or forest models. Ongoing work at IVC has made it possible to render hundreds of square kilometres of forests with very detailed tree models at interactive framerates. The same technology applies to city models.

Computer Graphics Laboratory

The computer graphics lab serves as a platform for dealing with topics from the areas of interactive environments, virtual reality, image synthesis, and interaction. The work done here often covers multiple of the mentioned fields and the important topic of parallel systems in computer graphics is also dealt with in several projects (especially image synthesis and post-processing). The aim of our lab is to provide a place for students to work on their projects and theses and also a place for our researchers to do their work. Several third-party funded research projects have been undertaken here and led to conference contributions in various fields such as real-time image post-processing, ray tracing or even plant covering simulations. Recently, research and student projects that use next generation Head Mounted Displays (HMDs) have been conducted in the computer graphics lab. Projects range from adoption of game engines for HMDs to basic research about the effects of multi-modal output in addition to stereoscopic visualisation.

To support efficient physically based rendering of complex scenes, IVC operates a number of high-end graphics clusters with multiple modern GPUs. In addition, IVC operates low-end and very high-end display systems, such as the seven by three meters 72 megapixel tiled video wall and other installations, including a smaller three by two meters stereo projection wall. For optimal interaction with those, several industrial standard input devices (6-DoF, force feedback etc.) are available, while IVC also develops its own specialised input devices. The results of our work on interactive, high-quality visualisation have been presented at international conferences and workshops. Our experience and practical know-how on large, ultra-high resolution displays was shared in a tutorial at the IEEE VR 2015 conference in Arles, France.

Simulation

At IVC, experiences in modelling and simulation of complex processes and structures are distributed over various application areas. They range from traffic simulations on the micro- and macroscopic level to illumination simulations in indoor scenarios and from biochemical simulations as well as modelling and simulation of electromechanical components and of industrial processes and machinery.

The very successful bicycle simulation project has been notably improved by the development of cognitive agent models that catch the uncertainty and risk taking processes of other traffic participants. By doing so, it could

be demonstrated that the realism of the simulation of microscopic traffic processes can be greatly improved. The underlying technology of cognitive agent modelling can be transferred to several different application areas that require the modelling of individualised characters and behaviours of a number of entities. It could be shown that several processes that could so far not be simulated, were modelled and evaluated successfully without exceeding the available computational resources.

Another example where simulation meets reality is the SimuBridge project. This project enables the realistic simulation and physically correct behaviour of different systems and machines under the control of a real programmable logic controller (PLC). Without the need for maintenance of physical equipment and machines, this simple concept of mixed reality supported by an electrical interface will enable new levels in learning basic principles of PLC programming.

Computer Vision

The processing, reconstruction, and analysis of images and other visual data represent a major part of the Computer Vision research. At IVC image processing experience has been accumulated in several different application domains. In industrial applications, object detection tasks under real-time conditions are of high interest. For that, video sequences have to be processed and analysed under strict time constraints. Moreover, specifications on the reliability, precision, and accuracy enforce powerful and efficient methodological approaches. For real world applications, robustness requirements, including indoor as well as outdoor conditions, additionally contribute to the complexity of the vision problems to be solved. Varying illumination conditions as well as mixed lighting set-ups require special methodological treatments to ensure high detection quality and reliability. Many Computer Vision applications with industrial partners have been successfully concluded in the past years. For instance, the detection of humans and in particular their faces as well as the detection of car's licence plates have been realised for outdoor image data with varying illumination conditions. It could be shown that even partially occluded faces and licence plates are detectable at low error rates. The developed approaches were able to accept a high bandwidth of scales of object's visual appearances. The overall detection results were further improved by intelligent post-processing mechanisms that minimise the detection errors.

The Computer Vision know-how at IVC is shared with industrial cooperation partners upon request and joint research and development projects are undertaken based on the commercial partners' conditions. Moreover, the knowledge is passed over in specialised lectures to students of our own institutions and those of our international partners. In addition to the core topics of Visual Computing, there are many other research areas closely associated with or at least touched by Visual Computing topics.

Computer Vision is about teaching computers to see: How to transform an image consisting of nothing more than pixels into a semantic representation that allows for detecting and analysing objects? With camera systems integrated in modern automobiles, it is possible to track the traffic lane, detect obstacles and other vehicles, and warn the driver or even perform emergency braking or evasive manoeuvres in hazardous situations. Autonomous air, space and ground vehicles (such as the Mars rovers or other Unmanned Aerial Vehicles, UAVs) also rely mostly on Computer Vision to perceive their environment, detect objects, and plan their next actions.

Even in the home entertainment industry, Computer Vision nowadays plays a major role: State-of-the-art gaming consoles are capable of detecting a player's motion via 3D cameras and thus allow for entirely new gaming concepts.

Perception

Human perception is one of the fundamental ingredients of Visual Computing because the final recipients are supposed to be humans, and therefore, in many VC research projects, perception-related topics are addressed. Perception is the subject of several IVC research projects. Human perception and, in particular, human self-orientation is investigated in collaboration with our Canadian partners. For that, several of our visualisation environments are used in visual experiments. Human perception is also simulated as a whole, in particular within the traffic simulation context, in which a virtual perception approach has been realised under real-time processing conditions. It simulates the limited visual perception of traffic agents under varying outdoor conditions.

Sensor & Sensualisation Laboratory

The Sensor & Sensualisation Lab develops systems and algorithms for gaining, analysing, and presenting information. Analysis of sensor systems aims particularly at modelling perception processes inspired by biological systems. Using approaches as fuzzy logic, reliable information can be extracted from data with poor or limited accuracy. Methods developed in this context can be applied to a large variety of problems, ranging from chemical descriptors derived from molecular surfaces to improved image processing procedures. Human-Computer Interfaces (HCI) can augment perception by intuitively integrating technical sensors and mapping information adequately to not only visual (but also other sensual) representations on the incoming side, or, with outgoing electro-encephalographic (EEG) signals, navigate robots and avatars through real and virtual environments. Storytelling-oriented interaction metaphors in hypermedia cross-platform applications allow for personalised configuration of various information systems.

Human-Computer Interfaces

A very special type of Human-Computer Interfaces does not require any metaphorical work-around but goes directly from the human brain to the computer. These Brain-Computer Interfaces (BCI), usually based on electro-encephalographic measures, are now also available at a reasonable price, apart from those for medical applications. We have shown that with low-end BCI technology it is possible to send simple navigation commands, and we are now exploring the limits of the applicability of these systems for more complex tasks. Another research direction is to include it as a navigational device in fully immersive Virtual Reality environments. There has also been some work on workbench-based VR devices for prosthesis training of disabled people. Current projects aim to investigate the different uses of neural feedback in triggering input signals in case the other input methods are not possible or not comfortable. The secondary goals of these projects are to investigate the reliability and accuracy of the BCI devices in detecting natural human thoughts.

Hypermedia Storytelling

Hypermedia Edutainment aims at enhancing motivation in learning scenarios. New approaches to storytelling-based systems for personalised eLearning applications are under development. Hypermedia Novels organise complex content in narrative threads in a hierarchy of parallel/serial containers with personalised paths through a modular media structure. Interactive digital media platforms derived from classical comic strips offer various options for Edutainment, including language learning seamlessly integrated with entertainment.

Biological Simulation

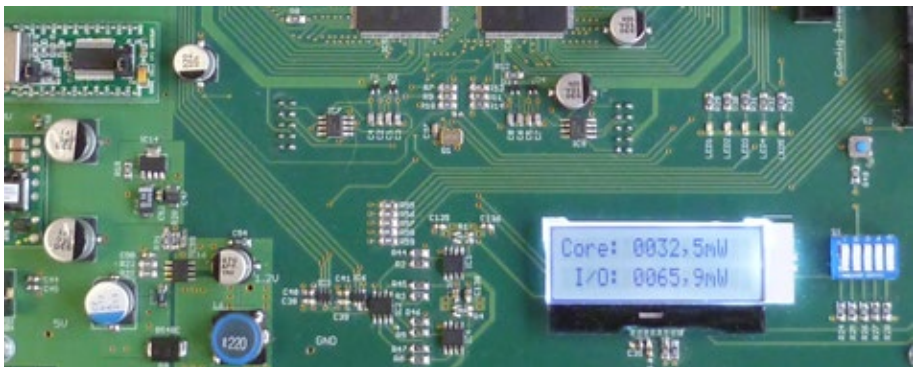
Among social life forms, slime molds hold an outstanding position with their ability to build optimised networks, together with their adaptability to changes in environmental conditions by migratory activities and their associative and dissociative behaviour as either independent mono- or multicellular organisms. Ongoing work deals with simulating and visualising different behaviours of slime mold and other biological systems.

FPGA-based Video Processing

In the field of Visual Computing hardware, FPGA-based systems and their architectures are developed to implement video processing algorithms. Field Programmable Gate Arrays (FPGA) are well suited for this application because they match the requirements of the algorithms. FPGAs are programmable and can be adapted to the required task. Therefore FPGAs are well suited for rapid prototyping.

Due to the large number of image pixels in modern display systems, high computational power is required. Video content often has to be processed under real-time conditions, particularly in safety-related applications. This corresponds to a high data throughput when the image has to be transferred to and from the processing unit. Beneficial for a hardware implementation is the regularity of many image processing algorithms, allowing a high level of parallelisation. Especially for the computationally intense low-level processing, where every pixel of an image undergoes the same sequence of operations.

can be exploited in low-level processing while pipelining of processing units is often more suited for high-level processing. Therefore for a compact implementation, algorithm developers should have a concept of the hardware, and at the same time, system designers should understand the algorithm they are implementing.



Today, with the Internet of Things (IoT) advancing, digital circuits can be found hidden in more and more products where they are generally not expected. Nowadays, even coffee machines and refrigerators are controlled by digital circuits. In Voice-over-IP telephones, they transform speech into a digital representation to send it to the recipient's phone, where it is converted back into sound waves. In the receiver for digital TV, a digital circuit runs millions of calculations per second to reconstruct the video sequence from the received data. In the Digital Design Laboratory, students of electrical engineering learn to develop their own digital circuits. The students describe the function of the circuit using a hardware description language such as VHDL. The circuit is then loaded into a programmable digital circuit, a Field Programmable Gate Array (FPGA). Now, students can check whether the circuit behaves as desired. Finally, the laboratory provides all the equipment necessary for analysing the circuit's behaviour and finding possible errors.

Architecture for Video Processing Systems

A video processing system can be implemented, exploiting the advantages of FPGAs and a CPU or a microcontroller with sequential processing. A typical implementation will use the FPGA for pixel by pixel low-level processing. On a higher level of the algorithm, the controller will use the intermediate results and perform calculations that are more complex regarding the control flow but require less computational power. This controller can be a PC or a Soft Core microcontroller inside the FPGA. The distribution of tasks between the processing units depends on the video processing task and requires algorithm developers and system designers to interact. Computational power, storage requirements and data bandwidth need to be taken into account. Parallelism

Low-Power for Education

We focus our current research on the use of video processing implementations as a way of facilitating an understanding of computing requirements and energy demands. For electronic systems, power dissipation has become a design constraint, as important as size, weight, cost, or time to market. It is one of the most important aspects for battery-powered devices, allowing longer running times and less maintenance.

Low power consumption, in general, can reduce the effort for heat management, thereby cutting electricity bills and slowing down the aging of integrated circuits due to thermal effects, providing benefits of reduced energy consumption from the environmental point of view.

Professors

Prof. Dr. André Hinkenjann
Co-director of the Institute of Visual Computing

Dr. André Hinkenjann is a full research professor for Computer Graphics and Interactive Environments at the Bonn-Rhein-Sieg University of Applied Sciences (HBRS) in Sankt Augustin, Germany. He received his Diploma in Computer Science from TU Dortmund. After that he worked at Fraunhofer IAO in Stuttgart on one of Germany's first VR installations. Dr. Hinkenjann received his PhD from TU Dortmund. Since 2012 he has also been the founding director of the Institute of Visual Computing. His main research areas are Interactive Environments, Visualisation, Efficient Global Illumination, and Ultra-High Resolution Display Systems. He is a member of IEEE, ACM SIGGRAPH, Eurographics, and the German Informatics Society and a regular reviewer for many international conferences and workshops in the field of computer graphics and interactive environments.

Prof. Dr.-Ing. Rainer Herpers
Co-director of the Institute of Visual Computing

Dr. Rainer Herpers is a full professor in the Department of Computer Science at Bonn-Rhein-Sieg University of Applied Sciences. In 1997 he received a PhD in Computer Science from the Faculty of Engineering, Kiel University, Germany. Since 2001 he has held an adjunct faculty position at the Faculty of Graduate Studies at York University, Toronto, Canada and since 2008 an adjunct faculty position at the Faculty of Computer Science, University of New Brunswick, Fredericton, Canada. He is currently serving as founding director of the Graduate Institute and as co-director of the Institute of Visual Computing. His research interests are Image Processing, Computer Vision and Computer Graphics with an emphasis on Virtual Environments and Virtual Reality, Multimedia Applications, Medical Informatics, and Health Telematics. He received a grant for three Tempus and two EU/Canada projects. He is actively involved in other international collaborations.

Prof. Dr. Wolfgang Heiden
Professor for Computer Science, in particular Multimedia and Hypermedia systems

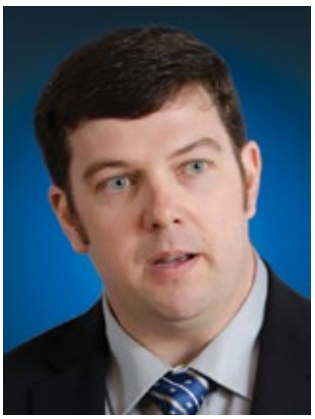
Dr. Wolfgang Heiden is a full professor at the Department of Computer Science of Bonn-Rhein-Sieg University of Applied Sciences, with a background in Biology, Chemistry, and Scientific Visualisation, covering various topics within the field of Multimedia/Hypermedia and Life Science Informatics. He holds a Diploma in Biology from Würzburg University and a PhD from the Technical University Darmstadt, Germany. Post-doctoral activities include the coordination of an international R&D project on Distributed Video Production over broadband networks, funded by the European Commission. Current research and teaching activities focus on Hypermedia Edutainment, Molecular Modelling and Visualisation, and Biological Simulation. He has acted as a scientific and academic reviewer for the European Commission and for the German Academic Exchange Service (DAAD). He is also a founding member of the Competence Centre Bioengineering NRW, established in 2003, and has been Dean of the Computer Science Department of HBRS since October 2010.

Dr. Marco Winzker studied Electrical Engineering at the University of Hannover and received his PhD for work on low-power CMOS design. As a design engineer and group leader, he developed image processing systems with ASICs and FPGAs. He worked for Phillips Semiconductors (now NXP) in Hamburg and Eindhoven and for Liesegang electronics and Silicon Optix (now IDT) in Hannover. Since 2004 he has been a professor at Bonn-Rhein-Sieg University and the Associate Dean of the Engineering Faculty. He has been selected as participant for the excellence in education programme "Lehre-hoch-n". At IEEE Educon 2012, he received a best paper award for his contribution on time-slots for project-based learning. Currently he is the project manager for Pro-MINT-us, a university-wide project in the "Qualitätspakt Lehre" (Teaching Quality Pact). His research interests are FPGA design, low power design, and student-centred teaching.

Prof. Dr.-Ing. Marco Winzker
Professor for Digital Design & Fundamentals of Electric Circuits

Dr. Dirk Reith studied physics, mathematics, and education science at the Johannes-Gutenberg University, Mainz, Germany and at Uppsala University, Sweden. He joined the Max-Planck-Institute for Polymer Research (MPI-P) at the university in Mainz in 1999 and completed his PhD there in physical chemistry in 2001. From 2002 till 2006 he was engaged in sales forecasting as an IT project manager and business analyst, working in the "Center of Competence Global Ordering" at Daimler Chrysler AG, Stuttgart, Germany. He then joined the Fraunhofer Institute for Algorithms and Scientific Computing, where he founded and led the Computational Chemical Engineering Group. Since September 2012 he has held a professorship for modelling and simulation in the Department of Mechanical Engineering at HBRS. Scientifically, his emphasis lies on molecular simulation techniques for soft matter including their visualisation as well as on finding solutions to practical industrial problems.

Prof. Dr. Dirk Reith
Professor for Engineering Fundamentals & Simulation



Dr. Kenneth Kent is a professor of Computer Science at the University of New Brunswick (UNB), Canada. Having served as the Director of the Information Technology Centre, he cooperates with industrial partners including IBM, Altera, and GTECH. His collaboration with IBM has led to the creation of the Centre for Advanced Studies - Atlantic at UNB where he is the founding Director. His research interests in Virtual Machines and FPGA Architectures have led to numerous publications and a number of tools widely used in the open-source community. He is an active member in the scientific community having served as co-programme chair, co-general chair and steering committee member of the IEEE Rapid Systems Prototyping Symposium and co-programme chair of the Highly Efficient Architectures and Reconfigurable Technologies Workshop. He is a member of the National Science and Engineering Research Council Strategic Grant selection committee and an executive board member of Science Atlantic.

Prof. Dr. Kenneth B. Kent
Director of IBM Center for Advanced Studies - Atlantic


Total
Self
Calls
GC Alloc
Time ms
Self ms
Object

In our first bi-annual report, we covered the years 2011 and 2012. Now, in the middle of the IVC funding period, we can report that only 30% of the annual funding is seed funding, and the rest is contributed by third parties. When the IVC was founded, we promised to achieve at least a 1:1 ratio between third-party funding and seed funding. By now, after four years of successful operation, we have used roughly 1 million Euro of seed funding, while having acquired about 3 million Euro from third-party projects.

In 2013, the three major sources of funding were seed funding with 27%, the Federal Ministry of Education and Research (BMBF) with 33% and the Federal Ministry for Economic Affairs and Energy (BMWi) with 18%. All BMBF and BMWi funded projects were joint projects with industry, especially with SMEs. The remaining budget was funded by companies and mobility programmes (EU, DAAD, Alexander von Humboldt).

In 2014, the seed funding percentage increased to 32%, while BMBF, BMWi and the state of North Rhine-Westphalia funded about 35%. The rest was contributed by companies and mobility programmes.

The eight IVC professors were funded by the Bonn-Rhein-Sieg University of Applied Sciences. The 20 research associates and 15 research assistants were mainly funded by third-party projects. Interim financing was covered by IVC's seed funding.

Within the two years, 59 publications were accepted for conferences, journals, workshops, symposia, and exhibitions (page 34). 24 Bachelor and 23 Master theses were supervised by IVC professors (page 38) and 21 lectures were given on IVC related topics (page 29). The Institute of Visual Computing has 14 PhD students who are doing joint research with colleagues at the Saarland University, Brunel University London, University of Bonn, University of Siegen and University of Rostock. One IVC member received a professorship at the University of Applied Sciences in Wiesbaden.

The Visual Computing Colloquium continued to be very successful. We received a number of lectures from colleagues from Germany and other countries, such as the US and Japan (page 42).

The Institute of Visual Computing received additional awareness in national TV shows and exhibitions reporting and presenting its scientific achievements (page 45).

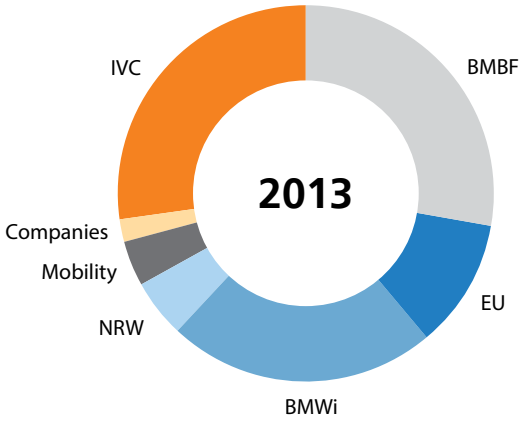


Figure 1: Relative distribution of seed (IVC) and third-party funding in 2013

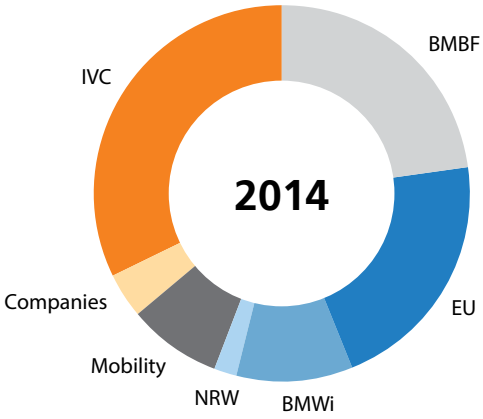


Figure 2: Relative distribution of seed (IVC) and third-party funding in 2014

Big Data on the Big Screen

The inauguration of the high-resolution display screen HORNET attracted researchers both from the University and from external institutions as well as company representatives and the local press. Prof. Dr. Manfred Kaul, Vice President for Tuition, Studies and Further Education, and Prof. Dr. André Hinkenjann, director of the Institute of Visual Computing, welcomed their guests before various members of the institute demonstrated some of the areas of application for the big screen.

Oliver Jato, Jens Maiero and Thorsten Roth delivered an insight into rendering methods, such as path tracing, which allow for the simulation of global illumination. Physically-based rendering produces high quality, high resolution images. The HORNET screen with its powerful adjacent cluster makes this high quality possible. Results can be useful for the photorealistic visualisation of architecture in construction planning and during design-review processes in the automotive industry. Another area of application is climate research. Extensive data collections can be reviewed by several scientists as a team due to the proportions of the screen.
The installation will not only be used for teaching and research within the department of computer science; external partners are welcome to use the big screen for their projects as well.

Jessica Millberg demonstrated ways of interacting with the screen: The user is tracked and calibrated by a camera and can then move through a three-dimensional scene. IVC researchers have also developed navigation tools for common desktop applications. As mouse and keyboard become impractical due to the dimension of the HORNET wall, the user's hand becomes the control device. The system can differentiate between an open hand and a closed hand, and the user can scroll through texts by gripping the air in front of the screen.

Using biomolecular visualisations, Prof. Dr. Wolfgang Heiden and Dr. Karl Kirschner showed how the big screen can deliver additional insights into Life Sciences. By visualising raw data, e.g. in drug design, the researcher can develop a scientific intuition. This advantage becomes instantly clear when, instead of endless rows of numbers, huge molecules move across the screen, which either fit perfectly together or do not match in their structure.

Two of the department's most recent graduates, Mr. Konstantinidis and Mr. Kopp, presented an interactive game they had developed as part of their Master's theses. The characters are controlled via smartphone and, contrary to most games, player communication and interaction is needed in the real world to solve the given tasks.

Martin Weier took the guests on a trip around the world in eight minutes. The projection of Google Earth data on the big screen is ideal for appreciating the extremely high display resolution. Zooming in can be done simply by approaching the screen. Even at a distance of only a few centimetres, the picture is still sharp.

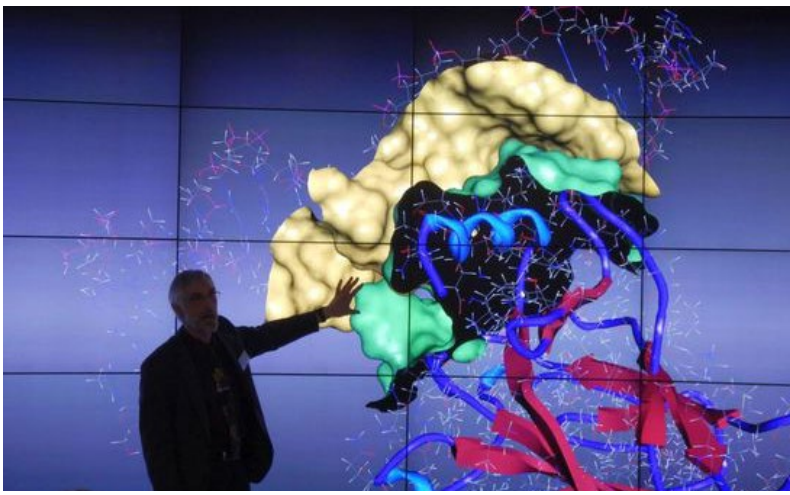
HORNET was financed through the "FHInvest" programme of the ministries of research of Germany and North Rhine-Westphalia.

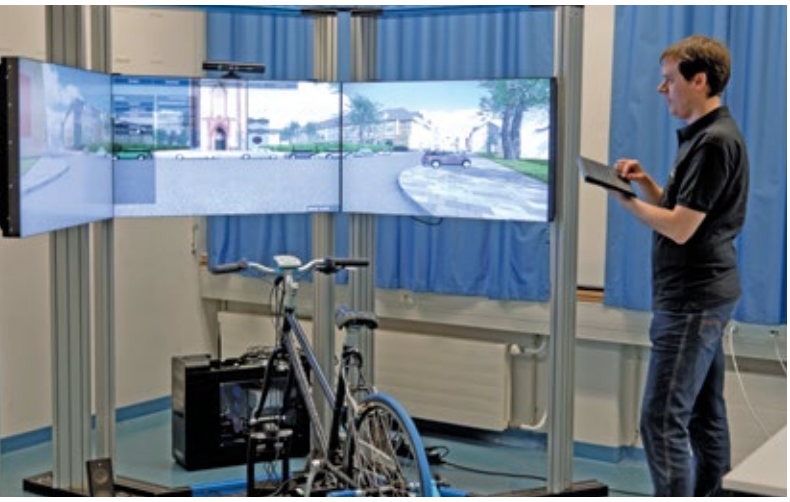
Technical Details

HORNET is an ultra-high resolution of 72 megapixels tiled display system which can be used for large-scale visualisation of big data, collaborative data exploration, and for 1:1 high quality rendering of new products. The large display surface is slightly curved, measures approximately seven by three meters and consists of 35 Full-HD monitors with very thin bezels. The pixel density is high enough to exceed the resolution of the human eye when standing more than three meters away from the monitors.

The display monitors are driven by three display PCs that each have three state-of-the-art NVIDIA GTX 780 graphics cards. These graphics cards are capable of producing traditional 3D graphics in real-time for moderate scene sizes. 12 cluster PCs are utilised to render global illumination images, each using three GTX Titan cards. These PCs are located in a remote server room and are connected by a 60 Gbit/s fibre Ethernet link to the display PCs. Once rendering is completed, the images are transferred to the display PCs and subsequently distributed to the wall's monitors.

Interaction with HORNET is supported by an optical tracking system, consisting of seven tracking cameras with infrared illumination.





Fivis

Immersive Bicycle Simulator for Road Safety Education

The project's goal is to develop a compact and mobile, yet immersive, bicycle simulator that can realistically simulate potentially dangerous road traffic situations without exposing the rider to an actual risk. The simulator is being used to educate children in proper urban traffic behaviour.

The simulator features a compact immersive visualisation system consisting of three almost bezel-free flat screens providing a field of view of approximately 180°. The rider interacts with the system using a mounted bicycle equipped with a steering sensor and an electric motor brake that is capable of simulating ascents and descents. A Kinect-based marker-less tracking system detects hand signs and head motion, which can be contextually interpreted by the simulation. The 3D visualisation is computed by a single PC with a high-end graphics card running the Unity game engine. Recent additions to the system include the support for HMDs (Oculus Rift) and a physically based day/night simulation with real-time Global Illumination.

Financial support from the German Social Accident Insurance (DGUV) grant no. FP307 and the FH³ grant No. 1736A05 is acknowledged.

Duration: 01 July 2006 – to date
Contact: Prof. Dr.-Ing. Rainer Herpers, David Scherfgen, M.Sc.

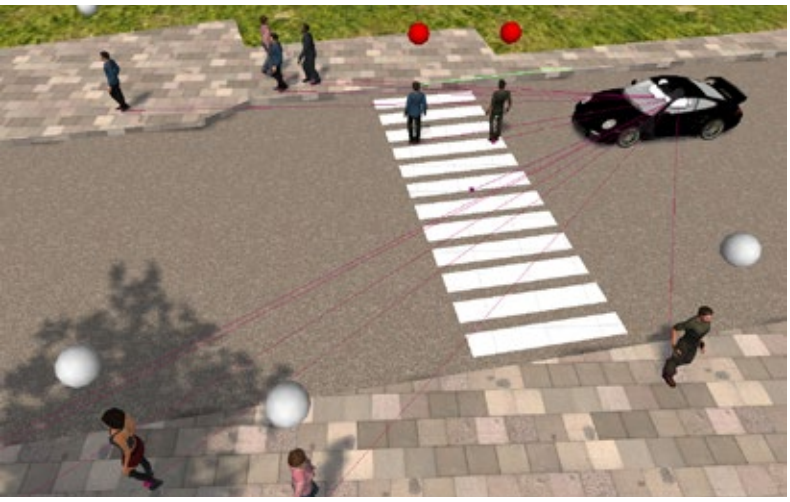
AVeSi

Agent-based Traffic Simulation with Psychological Personality Profiles

The objective of the AVeSi project is to simulate more human-like road traffic behaviour by considering risk taking and mistakes. Real-life traffic participants have to follow traffic rules, but these rules are often broken to varying degrees, ranging from speeding to running red lights to ignoring priorities. In this context, virtual environments may provide a safe environment for road safety education. However, for this training to be most effective, simulated traffic participants (agents) need to behave like their human counterparts. To achieve this behaviour, cognitive processes performed by the agents were modelled and implemented. Furthermore, personality profiles were assigned to each agent to provide diversified behaviour and different driving types (e.g. aggressive vs. careful). During the course of the project, multiple subprojects were successfully completed, such as an implementation of personality profiles and an emotion model based on psychology research, an efficient mesoscopic traffic simulation, the definition of a semantic road network representation, and the integration of a perception framework (SynPeA). Furthermore, the agent architecture was re-designed to support generic agent types.

The AVeSi project was funded by the Federal Ministry of Education and Research (BMBF) grant No. 17028X11.

Duration: 01 October 2011 – 30 September 2014
Partners: Institut für Arbeit und Gesundheit der DGUV, Virtual Köln, Bernhard Lang Fahrradsimulation, Rhein-AhrCampus Remagen, Universität Bonn, Fraunhofer IAIS
Contact: Prof. Dr.-Ing. Rainer Herpers, Sven Seele, M.Sc.



SynPeA

Synthetic Perception for Agents

The objective of the SynPeA project (Synthetic Perception for Agents) is to develop a generic framework for simulating the perception of virtual agents. The framework should provide agents with a distinct set of environmental information including what their real counterparts could or would also be aware of. Realistically simulated perception should provide a strong tool for increasing the realism of the simulated behaviour of entities.

The virtual perception process is split into three sub-processes: sensation, memory, and retrieval. The sensation is simulated by a set of virtual sensors that retrieve sensible signals or objects in the environment. Integrated visual sensors are able to solve problems such as occlusion or view range restrictions. The memory sub-process has a psychology-based memory model that includes several stages, e.g. a sensory storage and a short-term memory. Information is requested through an interface allowing currently interesting information to be retrieved.

The process was evaluated by applying it to a traffic simulation scenario. The evaluation showed that the system facilitates the integration of functions to perform the task in the scenario. At the same time, the evaluation raised a couple of future objectives including the integration of further challenging features such as scene perception, attention, predictive perception, clarity, saliency, and sensors for further modalities (audio, smell, or touch).

Contact: Prof. Dr.-Ing. Rainer Herpers,
Tobias Haubrich, M.Sc., Sven Seele, M.Sc.

SimuBridge

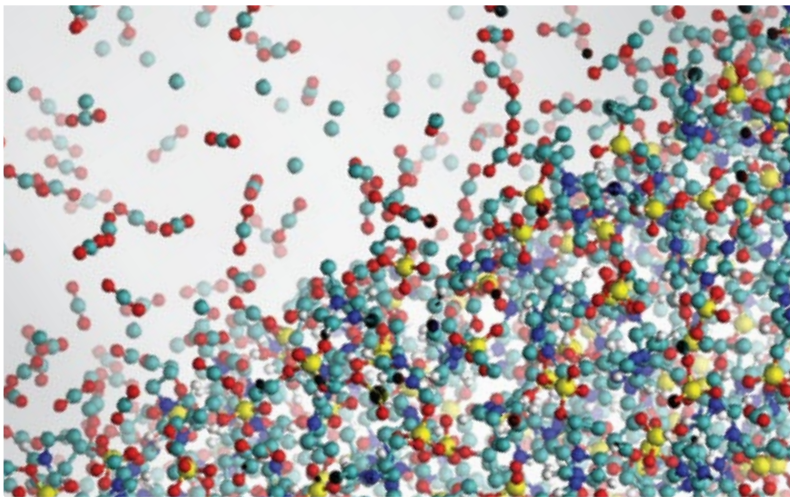
System Simulator Controlled by a Generic PLC as an Innovative Learning Concept

The project objective is to develop a generic visual simulator of devices, systems and industrial plants, independent of a particular Programmable Logic Controller (PLC) vendor. This simulator platform will be part of an innovative learning concept for PLC programmers. The platform consists of a conventional PLC, a special I/O adapter, and a PC. The visual system simulator contains a PC software part that offers a number of training tasks with 3D visualisation. The system will have multi-lingual support for task descriptions and the user interface.

Major focus areas in this project are realistic simulation of devices and their physical characteristics, realistic behaviour and reaction of the simulator on real control signals, as well as correct visual representation of real-time events and modulated signals with low latency. Special features, such as inducing simultaneous multiple failures and other malfunctions, have been recently integrated into the simulator. The simulation addresses the correct representation of high frequency input signals and how to adequately react to them.

Funded by the Federal Ministry for Economic Affairs and Energy (BMWi) under the Central Innovation Programme for Small and Medium Sized Enterprises (ZIM) grant No. KF2992401.

Duration: 01 July 2012 – 31 July 2015
Partners: FELTRON Elektronik-ZEISSLER & Co. GmbH.
Contact: Prof. Dr.-Ing. Rainer Herpers,
Dipl.-Ing. Timur Saitov, M.Sc.



HORNET

Interactive High Resolution Display Wall

HORNET is an ultra high resolution display wall that is driven by a visualisation cluster. It enables immersive visualisation of large scientific data sets as well as 3D models with physically based illumination techniques.

Some examples of possible applications of the display include high quality scientific visualisation of large data sets, design review of products, and different forms of distributed collaboration. To our institute and our partners, HORNET opens up the relatively new field of research that addresses concepts of interaction and collaboration with such display walls. One of the features of such system is simplicity and convenience in zooming into the data set. With this high resolution, it can be achieved by simply stepping towards the display to enhance details without losing any contextual information.

The acquisition and installation of HORNET was funded by the 2013 "FHInvest" programme of the Federal Ministry of Education and Research (BMBF) grant No. 03FH005IN3 and the Ministry of Innovation, Higher Education and Research of North Rhine-Westphalia.

Partners: eyevis GmbH, imsys GmbH & Co. KG, Rolf Huwer Consulting
Contact: Prof. Dr. André Hinkenjann
Oliver Jato, M.Sc.

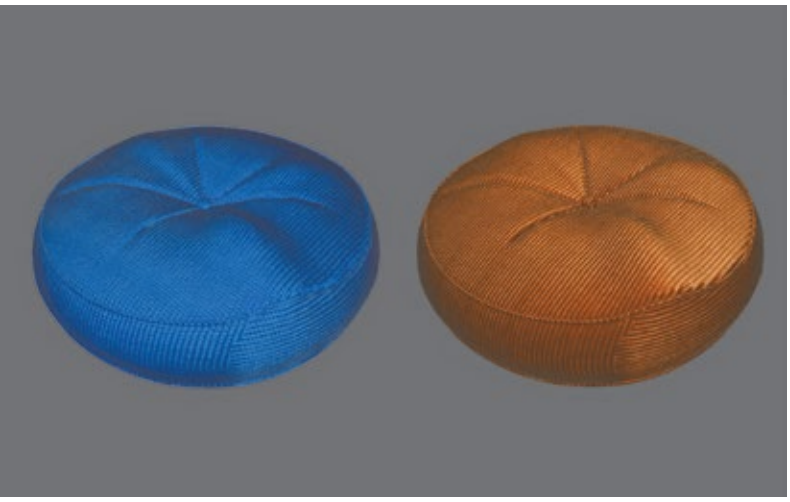
SkaSim

Molecular simulation

The basic idea of molecular simulations is to achieve valuable knowledge on the microscopic level in order to better understand processes and effects on the macroscopic level. Thus, they are extremely useful for scientists in many branches of industry, e.g. process engineering, material sciences, and biotechnology. In a joint research project, the Bonn-Rhein-Sieg University of Applied Sciences is working on the optimisation of the required fundamental basis, i.e. on molecular force fields, and their application on HPC-compatible hardware. In practice this means that models of the involved substances, which have to be as realistic as possible, must be developed first. As this is a nontrivial and tedious step, mathematical optimisation algorithms that can be executed in a highly parallel fashion need to be developed and implemented. Also after visual inspection of the chemical systems (e.g. using HORNET), efficient new methods of molecular simulation techniques can be used to simulate large and complex systems on huge computer clusters. Again, efficient visualisation and analysis of the data is crucial. If this task can be successfully completed, it means a huge knowledge gain for industry.

The project is funded by the Federal Ministry of Education and Research (BMBF) grant No. 01IH13005B.

Duration: 01 July 2013 – 30 Juni 2016
Partners: High Performance Computing Center Stuttgart (HLRS), TU München, TU Kaiserslautern, Universität Paderborn, Fraunhofer ITWM, Fraunhofer SCAI.
Contact: Dr. Colin Glass, HLRS, Prof. Dr. Dirk Reith



MATEDIS

Acquisition and Visualisation of High-Quality Materials

During the planning process of prefabricated houses, the manufacturers want to provide their customers with a realistic impression of the interior design and thus reduce costs and avoid misunderstandings. The objective of the research project MATEDIS is to capture and visualise materials and their specific surface properties and provide a genuine look and feel of future houses. A hardware setup consisting of several cameras and light sources gather the specific material properties under different viewing and illumination conditions. A single material results in hundreds of images, and compression techniques are being evaluated and implemented. This will help to reduce the data size and align it with the available memory. The intention is to visualise less complex materials on non-desktop environments such as tablet PCs. Like its predecessor project IVAB, MATEDIS' complex global illumination calculations are based on our own path tracer "Spark", which will be extended so that it can use the high-quality materials. The materials will be stored in a cloud database to make them easily available to the target audience.

This project is supported by the Federal Ministry for Economic Affairs and Energy (BMWi) under the Central Innovation Programme for Small and Medium Sized Enterprises (ZIM) grant No. KF2644109ED4

Duration: 01 September 2014 – 31 August 2016
Partners: Fraunhofer IAO, Softwareparadies GmbH & Co. Systemlösungen KG, Niemann und Piksa UG
Contact: Prof. Dr. André Hinkenjann, Thorsten Roth, M.Sc., Jessica Millberg, M.Sc., Philipp Frericks, B.Sc.

IVAB ("Spark")

High-Quality Rendering in the Planning of Prefabricated Houses

Various interactive, high-quality 3D rendering approaches are used that will enable constructors to make easier and more cost-effective decisions on interior design and fitting options. Among others, the research team uses a combination of path tracing (based on our own path tracer "Spark") and screen space post-processing (based on our graph-based framework "GrIP") to overcome noise artefacts.

For the perception of space, a realistic representation of the materials is essential as is an especially realistic light distribution, which can be implemented using a global illumination calculation.

For the research project IVAB, an overall solution was developed, which for the first time combines a realistic light distribution with a high-quality rendering of the materials for 3D representation of house manufacturers' offer.

This project was supported by the Federal Ministry for Economic Affairs and Energy (BMWi) grant No. KF2644106ED1.

Duration: 01 January 2012 – 31 December 2013
Partners: Fraunhofer IAO, PDV-Systeme Sachsen GmbH, Softwareparadies GmbH & Co. Systemlösungen KG
Contact: Prof. Dr. André Hinkenjann, Thorsten Roth, M.Sc., Anton Sigitov, M.Sc.

DMCT

Dynamic Marker Camera Tracking

A cost-efficient alternative to outside-in tracking systems (e.g. OptiTrack, Vicon) for pointing interaction with large displays is to equip the pointing device with a camera, whose images are matched to display content.

Dynamic Marker Camera Tracking (DMCT) is a framework for display-based camera tracking. It accounts for typical display characteristics, such as display lag and pixel response times, and employs on-screen markers that are virtually projected from the camera and can be reconfigured dynamically. DMCT can robustly measure pointing locations with sub-millimetre precision in large tracking volumes. Additionally, it computes 6-DoF camera poses that are suitable for 3D interaction. In contrast to previously implemented systems, DMCT supports multiple displays arranged in non-coplanar configurations, such as the HORNET display system.

In user studies, the prototype's pointing efficiency in target selection tasks was comparable to that of an OptiTrack system. An update rate of 60 Hz and a latency of 24 ms have been achieved.

Duration: 01 June 2013 – 31 May 2014
Partners: University of New Brunswick, Matrix Vision GmbH
Contact: Prof. Dr.-Ing. Rainer Herpers, David Scherfgen, M.Sc.

SightWalk

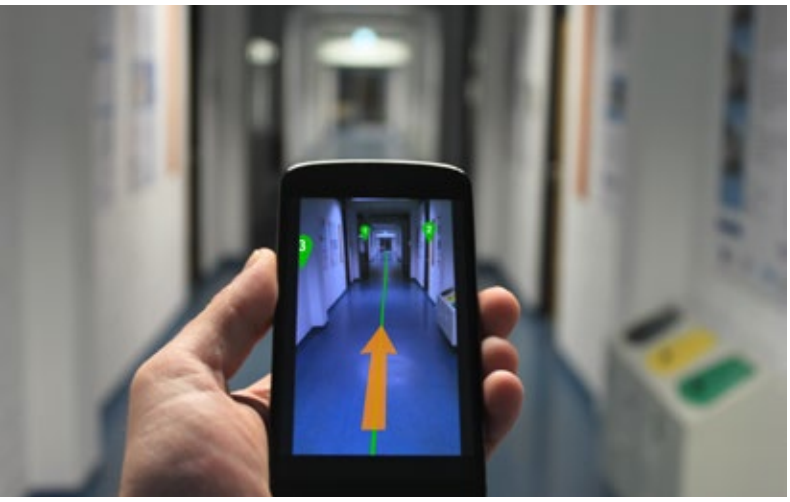
Automated Anonymisation of Faces and Licence Plates within Images

Some recently developed web-based applications, such as www.sightwalk.de of the Cologne-based project partner Panogate GmbH, present interactive pictures of urban environments online to the user. The enacted data protection regulations require recognisable faces or licence plates to be made anonymous. This is usually done manually for each and every image.

The project aimed to reduce this vast amount of work and automate the task. For the task of detecting faces, a slightly altered Viola & Jones detection algorithm has been implemented. This algorithm has been improved, by using a histogram-based post-processing approach to exclude false positives. The combined approach results in a detection rate of 84.53% and a 0.68 false-positive rate in all images provided by Panogate, with a detection rate of 90.42% for frontal faces and 58.84% for profile faces. These rates are still not sufficient for a fully automated anonymisation process. Nevertheless, the application is used to reduce the workload by preselecting likely faces and by guiding the user to images with the highest possibility of faces.

The project was funded by the Ministry of Economic Affairs, Energy and Industry of the State of North Rhine-Westphalia via the FH-Extra programme.

Duration: 01 November 2010 – 31 January 2013
Partners: Panogate GmbH
Contact: Prof. Dr.-Ing. Rainer Herpers, Thomas Hofhammer, B.Sc.



PlaSMoNa

Platform for Social Mobile Navigation

Navigation and position awareness are relevant issues for people in everyday life who want to get to a desired destination. People often have to deal with large and unknown scenarios, for instance a passenger looking for a gate in an airport. Motivated by this, the PlaSMoNa project aims at developing indoor localisation algorithms to provide a system to navigate people through indoor environments. Indoor localisation differs significantly from known outdoor localisation techniques. While the usage of satellites in outdoor navigation has been researched extensively, indoor navigation is currently a highly relevant research topic. Since GPS signals are not available in indoor environments, novel approaches need to be applied.

PlaSMoNa fuses data from Wi-Fi probability maps with the smartphone's built-in sensors to determine the user's position. For that purpose, a particle filter has been implemented. To improve localisation accuracy, a graph-based map-matching algorithm was added to the prototype. The project was tested and presented at various conferences by our partner.

The project was funded by the Federal Ministry for Economic Affairs and Energy (BMWi) under the Central Innovation Programme for Small and Medium Sized Enterprises (ZIM) grant No. KF2644105.

Duration: 01 January 2012 – 31 December 2013
Partners: tarent solutions GmbH
Contact: Prof. Dr. André Hinkenjann,
Dipl.-Math. Jens Maiero, M.Sc., Martin Weier, M.Sc.

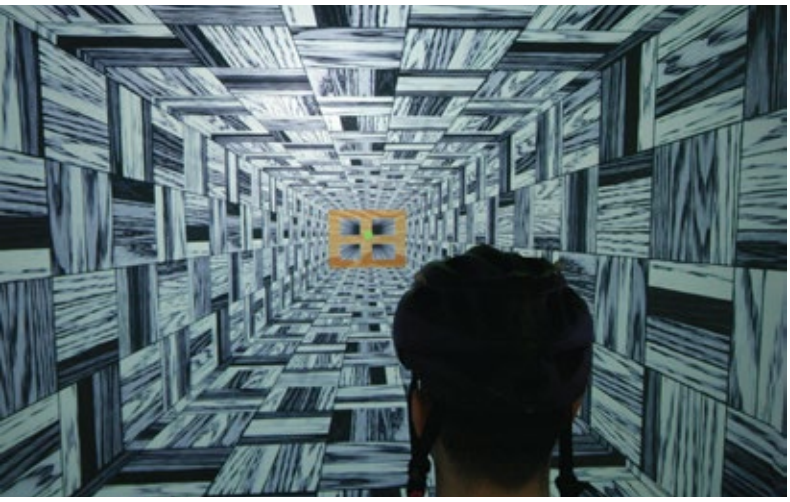
HDR Stereo Video

Registration of Differently Exposed Stereo Images

The dynamic range of a scene often exceeds a camera's capability and thus cannot be reproduced adequately. This limitation can be overcome by taking a sequence of differently exposed images each showing the same scene but representing a distinct fraction of its dynamic range. From this sequence, a High Dynamic Range (HDR) image can be calculated, containing the broader dynamic range of that scenery. Although this method works well for static images, and is in fact implemented in many consumer digital cameras, it is not suited for production of HDR video sequences where all images of the sequence would have to be taken at the same time.

In this project, a method was developed to produce HDR videos in real-time. For that, the images needed for HDR calculation are taken by a synchronised stereo camera operating with different exposure times. This means the cameras have to be calibrated to take into account parallax and possible occlusions as well as differences in exposure, with images of identical content but with different intensities. For a single camera, the dynamic range of the images could be extended by three f-stops, and could be further increased by using additional cameras. At the moment, without the use of hardware acceleration, the resulting frame rate on a test system with a 3.6 GHz Intel Core i7-3820 CPU was up to 5 frames per second.

Duration: 01 June 2013 – 31 May 2014
Partners: Matrix Vision GmbH
Contact: Prof. Dr.-Ing. Rainer Herpers,
Thorsten Hümpel, B.Sc.



Perception of Self-Motion

The Perception of Self-Motion in Virtual Environments

Humans and animals can use optic flow cues to judge the distance they have travelled, a skill known as visual odometry. In order to assess the relative contributions of the radial and laminar components of optic flow in visual odometry, we presented subjects with a visually simulated corridor that was viewed at different eccentricities relative to the direction of motion. Subjects looked down a simulated stationary corridor and viewed a target simulated at various distances beyond the reference frame. The video display was yoked to the head tracker. Subjects were passively travelled down the corridor and pressed a button when they felt the frame had reached the previously viewed target's position. Our results show that when optic flow is viewed eccentrically, the perceived distance travelled is affected by the viewing direction for a given pattern of optic flow. For the environment used here, optic flow produced a maximum perception of distance travelled when viewed about 20–30 degrees eccentrically.

The project was funded by the Alexander von Humboldt Foundation under the TransCoop programme.

Duration: 01 June 2009 – 30 June 2013
Partner: Centre of Vision Research at York University in Toronto, Canada
Contact: Prof. Dr.-Ing. Rainer Herpers, Dipl.-Psych. Sandra Felsner

PUG Study I and II

Perception of Upright Under Variation of Gravity States

The perception of upright depends on visual, gravity, and body cues, each of which is given a weighting by the brain. The first PUG Study showed that the influence of gravity on the perceptual upright rose from 0% to 23% with a transition at 0.2g. To evaluate particularly the situation at the threshold of 0.2g, more specific experiments have been designed. For that, the relative contributions of gravity to the perceptual upright were measured in ten subjects sitting on a short-arm centrifuge. Three different g-levels, measured at eye-level, were applied (0g, 0.41g and 1g). The measurements were taken by applying a tactile instrument using a small, touchable rod invisible to the subject. The orientation of the rod had been adjusted by an algorithm until participants chose the options "tilted towards me" and "tilted away from me" equally. The participants view had been occluded by a hood including a digital screen. On this screen, a virtual plane was shown manipulating the perceived visual vector. As a result, and in opposition to what had been expected, the final position of the tactile instrument was found to be tilted more outwards for higher g-levels than for 0g.

The project was funded by the Federal Ministry for Economic Affairs and Energy (BMWi) grant No. 50WB1260 and European Space Agency (ESA).

Duration: 01 July 2010 – 31 December 2013
Partners: Centre for Vision Research at York University, Toronto, Canada
Contact: Prof. Dr.-Ing. Rainer Herpers, Thomas Hofhammer, B.Sc.

OLIVE

Optimised Light Systems for Improved Productivity and Health

This collaborative project has set itself the goal of developing an integrative lighting system that will enhance health and productivity, while improving energy efficiency. In particular, the project looks into how the light received affects the circadian system of users and its diurnal course in different adjusted lighting needs, as such establishing a new understanding of intelligent lighting "iLight". For this purpose, medical studies will close gaps in the understanding of the effect of light on people, while chronobiological findings will parameterise lighting control.

The chronobiological parameters will be integrated in a sensor-equipped, parametrically induced light control concept connected to energy-efficient, dynamic LED lights. The research results will be visualised at the end of the project in a demonstration space to show the integrative cooperation of the systems. Some aspects of the research project, such as the effect of light on people, energy efficiency and ease of installation, can already be presented as results of individual demonstrators during the project.

This project is funded by the Federal Ministry of Education and Research (BMBF) grant No. 13N13161.

Duration: 01 August 2014 – 31 July 2017
Partners: ITZ Trilux GmbH, Arnsberg Vossloh-Schwabe GmbH, Kamp-Lintfort, Intellux GmbH, Lichtforum NRW, Charité, Fraunhofer IAO, Hochschule Bonn Rhein Sieg
Contact: Prof. Dr. André Hinkenjann, Dr. Ernst Kruijff, Oliver Jato, M.Sc., Dipl.-Math. Jens Maiero, M.Sc., Martin Weier, M.Sc.

EduPow

Evaluation System for Low-Power Design Education

The power dissipation of integrated circuits is an important aspect of sustainability in digital design. Students are aware of the need for sustainability and energy conservation, and accordingly, they will expect the issue of power dissipation to be addressed in their university education. But sustainability is not an end in itself. Low power dissipation allows long running times for battery-powered devices and can reduce the need for cooling in electronic systems.

The EduPow project addresses low-power electronics within a digital design course. An advantage of integrating this topic into the course is that it fosters greater interest among the students for both aspects: energy efficiency will not be presented as a separate subject, and digital design will be supplemented with state-of-the-art references and applications. The system uses a Field Programmable Gate Array (FPGA) as a programmable device for image processing tasks. Different image processing algorithms can be designed and programmed by students. A prototype of the evaluation system is available and used by students in their projects.

Funding provided by Erasmus Mundus and Kreissparkasse Köln.

Duration: 01 July 2011 – 30 June 2016
Contact: Prof. Dr. Marco Winzker.

Funding Programmes for International Cooperation

Avempace Erasmus Mundus

Avempace is the name for the Erasmus Mundus partnership project of about 20 universities in Europe and the Middle East Region (Jordan, Syria, Lebanon, Palestine). It organises a huge number of student and staff mobilities between Europe and the partner region. The Institute of Visual Computing has so far received two PhD scholars, two master students and a number of short term exchanges funded by the European Commission.

International Study and Training Partnerships (ISAP)

Within the ISAP programme ("Internationale Studien- und Ausbildungspartnerschaften"), DAAD is funding undergraduate and graduate student mobility from four to ten months stay. It is a group programme for highly qualified German and foreign students who complete a fully accredited study period of one or two terms within a partnership related to the specific field. The Department of Computer Science offered scholarships for its two Canadian partner universities, York University in Toronto and University of New Brunswick in Fredericton.

DAAD RISE Internships

The DAAD's RISE programme offers about 300 scholarships per year that allow undergraduate students from the United States, Canada and the UK to assist a doctoral student at a German university or research institute in an internship from two to three months. During the last two years, the Institute of Visual Computing was fortunate to host two interns from North America out of over 2,000 students who apply for RISE each year. The successful cooperation with two scholarship recipients has increased the interest in the programme within the institute. For the RISE 2015 round, five PhD students of the IVC and several others from the Computer Science department of the HBRS have internship offers in diverse research fields such as computer graphics, requirements engineering, artificial intelligence, robotics, and HCI.

In 2013, Xinyi Chen, a student at Dickinson College in Carlisle, PA, USA, and later at the Georgia Institute of Technology in Atlanta, GA, USA, performed several supportive programming tasks for the AVeSi project to enhance the usability of the GUI and the editor.

In 2014, Francis Beauchemin of the Université de Sherbrooke in Sherbrooke, Quebec, Canada, helped out in the FIVIS and AVeSi projects by designing and implementing a road network editor for the Unity Game Engine.

International Dual Degree Programmes

The Department of Computer Science is developing dual degree programmes with several partner universities. There are programmes that are installed at graduate and undergraduate level with the University of New Brunswick in Fredericton and York University in Toronto. Costs for student and staff mobility is funded by DAAD.

Open Source Software Communities

Open Source Software Communities and Rejuvenation of Technical Education and Innovation (OSSCOM) stands for a partnership project aimed at establishing and strengthening Open Source Software (OSS) Communities in the East Mediterranean area. The project, with a running time of approximately three years, is funded by the European Commission. The target groups include students and faculty as well as state institutions and small- and medium-sized businesses in Jordan and Lebanon. In the longer term, the initiative, which is based on a funded partnership between universities, intends to create new jobs in the IT sector of OSS. Partners to the project include educational facilities from Jordan, Lebanon, Spain, United Kingdom and Germany.

Contacts: Prof. Dr.-Ing. Rainer Herpers,
Nadine Kutz, M.A., Jana Shimizu, M.A.

SS'13

Hypermedia (BCS)	Prof. Dr. Heiden
Game Development (BCS)	Prof. Dr. Heiden, Prof. Dr. Hinkenjann
Fundamentals of Medical Image Processing (BCS)	Dr. Heisenberg
Computergrafik (BCS)	Prof. Dr. Hinkenjann
Fortgeschrittene Computergrafik (MCS)	Prof. Dr. Hinkenjann
Interdisziplinäre Anwendung von Visual Computing (MCS)	Prof. Dr. Hinkenjann
Digitaltechnik 2 (BCS)	Prof. Dr.-Ing. Winzker
Programmierbare Systeme - FPGA (BCS)	Prof. Dr.-Ing. Winzker
Digitale Signalverarbeitung - Komplexe Alg. (MCS)	Prof. Dr.-Ing. Winzker

WS'13/14

Wissenschaftliche Visualisierung (MCS)	Prof. Dr. Heiden
Einsteigerprojekt (BCS)	Prof. Dr. Heiden, Dr. Heisenberg
Interaktive Umgebung (BCS)	Dr. Heisenberg
Computer Vision (MCS)	Prof. Dr.-Ing. Herpers
Seminar Medieninformatik (BCS)	Prof. Dr. Hinkenjann
Interdisziplinäre Anwendung von Visual Computing (MCS)	Prof. Dr. Hinkenjann
Embedded Systems (MCS)	Prof. Dr. Kenneth Kent
Digitaltechnik (BCS)	Prof. Dr.-Ing. Winzker

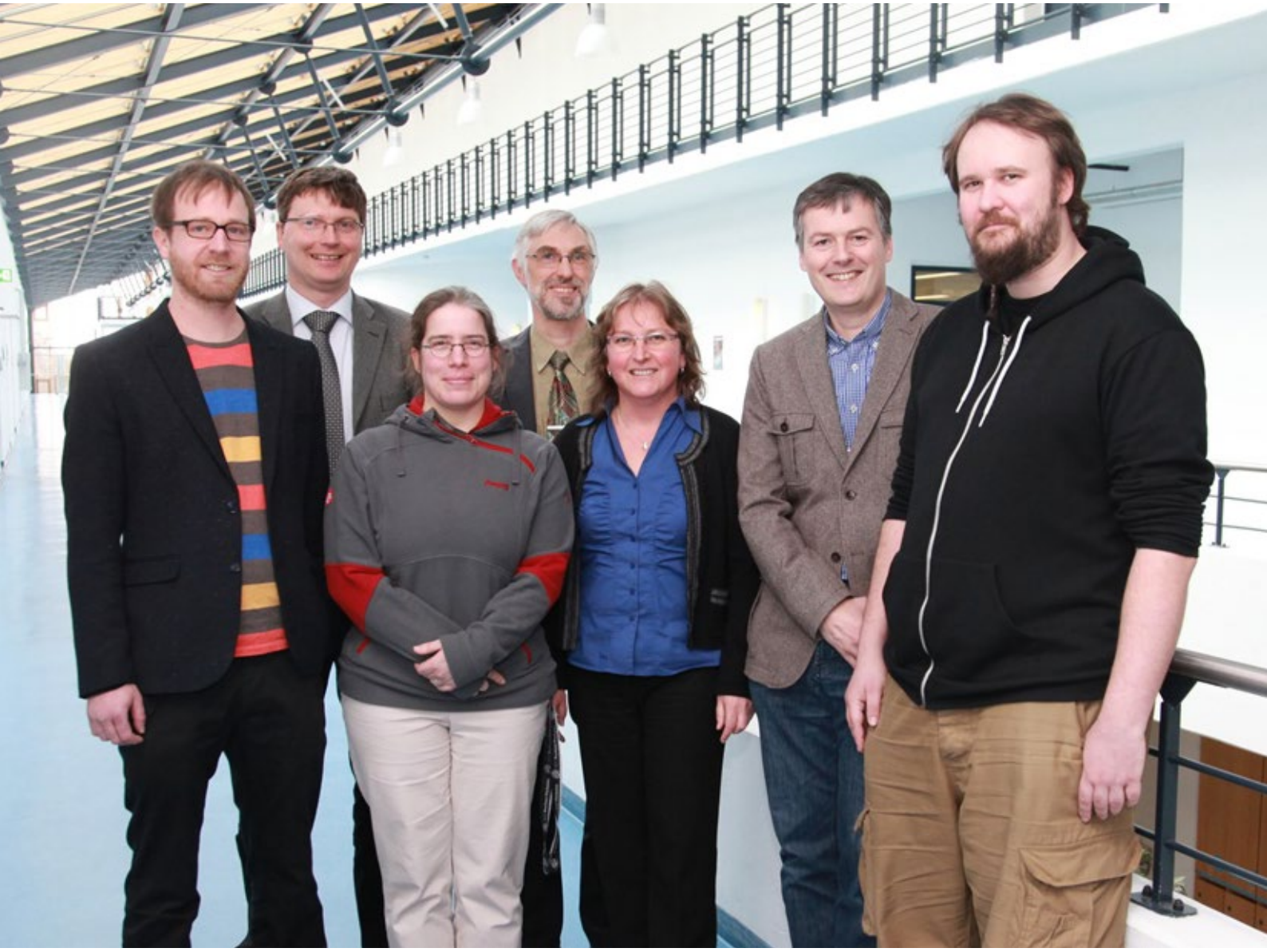
SS'14

Game Development (BCS)	Prof. Dr. Heiden
Fundamentals of Image Processing (BCS)	Prof. Dr. Heiden
Fundamentals of Bio-medical Informatics (BCS)	Prof. Dr. Heiden
Fortgeschrittene Computergrafik (MCS)	Prof. Dr. Hinkenjann
Computergrafik (BCS)	Prof. Dr. Hinkenjann
Interdisziplinäre Anwendung von Visual Computing (MCS)	Prof. Dr. Hinkenjann
Programmierbare Systeme - FPGA (BCS)	Prof. Dr.-Ing. Winzker
Digitale Signalverarbeitung - Komplexe Alg. (MCS)	Prof. Dr.-Ing. Winzker

WS'14/15

Multi-agents Systems by Biological Example (BCS)	Prof. Dr. Heiden
Game Development (BCS)	Prof. Dr. Heiden
Fundamentals of Medical Image Processing (BCS)	Prof. Dr. Heiden
Scientific Visualisation (MCS)	Prof. Dr. Heiden
Computer Vision (MCS)	Prof. Dr.-Ing. Herpers
Seminar Medieninformatik (BCS)	Prof. Dr. Hinkenjann
Interdisziplinäre Anwendung von Visual Computing (MCS)	Prof. Dr. Hinkenjann
Operating Systems II (MCS)	Prof. Dr. Kenneth Kent
Digitaltechnik (BCS)	Prof. Dr.-Ing. Winzker

PhD Students



Marcel Dombrowski
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
Object Locality in the Java Virtual Machine

Taees Eimouri
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
Object Model Cache Locality

Mozammel Hossain
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
The Verilog-to-Routing Project

Thaeer Kobbaey, M.Sc.
IVC supervisor
Prof. Dr. Rainer Herpers, Hochschule Bonn-Rhein-Sieg
Research topic
Human Robot Interaction

Jens Maiero, Dipl.-Math. (FH), M.Sc.
IVC supervisor
Prof. Dr. André Hinkenjann, Hochschule Bonn-Rhein-Sieg
External supervisor
Dr. George Ghinea, Brunel University London
Research topic
Ad-hoc Interaction in Spatial Augmented Reality Environments

Konstantin Nasartschuk
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
String De-duplication in the Java Virtual Machine

Panagiotis Patros
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
Multitenancy in the Java Virtual Machine

Siva Pulikallu, M.Sc.
IVC supervisor
Prof. Dr. Rainer Herpers, Hochschule Bonn-Rhein-Sieg
Research topic
Image Generation and Registration of Multimodal Data in Raman- and IR-Spectroscopy

Thorsten Roth, M.Sc.
IVC supervisor
Prof. Dr. André Hinkenjann, Hochschule Bonn-Rhein-Sieg
External supervisor
Dr. Yongmin Li, Brunel University London
Research topic
Improving Global Illumination Rendering by Using Light Field Information

Shatha Abu Shanab, M. Eng
IVC Supervisor
Prof. Dr. Marco Winzker, Hochschule Bonn-Rhein-Sieg
External Supervisor
Prof. Dr. Rainer Brück, University of Siegen
Research topic
Remote and On-Site Laboratory System for Low-Power Digital Circuit Design

Katharina Stollenwerk, Dipl.-Inform.
IVC supervisor
Prof. Dr. André Hinkenjann, Hochschule Bonn-Rhein-Sieg
External supervisor
Prof. Dr. Reinhard Klein, University of Bonn
Research topic
Natural two-handed Interaction for Virtual Environments

Bing Yang
IVC supervisor
Prof. Dr. Kenneth Kent, University of New Brunswick
Research topic
Java Packed Object Synchronization Framework

Sven Seele, M.Sc.
IVC supervisor
Prof. Dr. Rainer Herpers, Hochschule Bonn-Rhein-Sieg
External supervisor
Prof. Dr. Christian Bauckhage, University of Bonn
Research topic
Cognitive Agents for Microscopic Traffic Simulations in Virtual Environments

Martin Weier, M.Sc.
IVC supervisor
Prof. Dr. André Hinkenjann, Hochschule Bonn-Rhein-Sieg
External supervisor
Prof. Dr. Philipp Slusallek, University of Saarland
Research topic
Darstellung hoch komplexer Geometrien mit Level-of-Detail am Beispiel großer bewachsener Landschaften

Stefan Schuster
26 February 2013

Stefan Schuster has been awarded the Best DFF Student Paper Award for his paper "System design of an autostereoscopic 3D multiview interaction system". It was presented at the Electronic Displays Conference 2013 in Nuremberg.

Jessica Millberg
22 March 2013

Jessica Millberg's Master thesis on "Markerless Model-based Real-time Tracking for Augmented Reality Applications" won third place at this year's Best Paper Award at the "Informatik-Tage" (Computer Science Days) of the "Gesellschaft für Informatik" (Society of Computer Science).

Jessica Millberg
29 August 2013

Jessica Millberg won second place in the "AFCEA Studienpreis" (AFCEA students' award) for her master thesis on "Markerless Model-based Real-time Tracking for Augmented Reality Applications".

Oliver Jato
4 September 2014

Oliver Jato won third place in the "AFCEA Studienpreis" (AFCEA students' award) for his master thesis "Rendering Large Volume Datasets with CUDA".

Philipp Frericks
20 October 2014

Philipp Frericks' Bachelor thesis on "Implementierung eines bidirektionalen Path Tracers auf GPUs" (GPU-Implementation of a bi-directional Path Tracer) won the award for best Bachelor thesis during this year's "Fachbereichstag Informatik" (Computer Science Department Day) in Dortmund.

Sergey Alexandrov
25 October 2014

Sergey Alexandrov's Master thesis on "Geometric Segmentation of Point Cloud Data by Spectral Analysis" won the advancement award of the HBRS "Gesellschaft der Förderer" (Association of Sponsors).

Publications

2013

1. Aguilar Herrera, J.C., Hinkenjann, A., Plöger, P., Maiero, J.: Robust Indoor Localization Using Optimal Fusion Filter For Sensors And Map Layout Information, 4th International Conference on Indoor Positioning and Indoor Navigation (IPIN 2013), 2013.

2. Dettmar, T., Seele, S., Herpers, R., Becker, P., Bauckhage, C.: Efficient Mesoscopic Simulations for Persistent Agents in 3D-Applications and Games, 5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2013), pp. 93-100, 2013.

3. Dombrowski, M., Kent, K.B., Dawson, M., Gracie, C., Herpers, R.: Dynamic Monitor Allocation in the Java Virtual Machine, 11th International Workshop on Java Technologies for Real-time and Embedded Systems (JTRES 2013), Karlsruhe, Germany, pp. 30-37, 2013.

4. Halverson, J., Brandes, T., Lenz, O., Arnold, A., Bevc, S., Kremer, K., Stühn, T., Reith, D.: ESPResSo++: A Modern Multiscale Simulation Package for Soft Matter Systems, Comp. Phys. Comm. 184, 1129–1149, 2013.

5. Harris, L.R., Hecht H., Herpers, R., Hofhammer, T., Jenkin, M.: Wahrnehmung von „Aufrecht" unter verschiedenen Gravitationsbedingungen in einer Zentrifuge, Post IWG, DLR Bonn, Germany, 2013.

6. Harris, L.R., Jenkin, M., Hofhammer, T., Noppe, A., Herpers, R.: The Effect of Gravity on the Perceptual Upright: Centrifuge Experiments, 19th IAA Humans in Space Conference, Cologne, Germany, 2013.

7. Haubrich, T., Seele, S., Herpers, R., Müller, M., Becker, P.: Semantic Road Network Models for Rapid 3D Traffic Scenario Generation, Workshop der ASIM/GI-Fachgruppen STS und GMMS, Simulation technischer Systeme und Grundlagen und Methoden in Modellbildung und Simulation, Düsseldorf, Germany, 2013.

8. Herpers, R., Scherfgen, D., Vieth, M., Saitov, T., Felsner, S., Hofhammer, T., Schaefer, M., Huelke, M.: VR-Based Safety Evaluation of Automatically Controlled Machine Tools, 5th International IEEE Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2013), pp. 126-129, 2013.

9. Hinkenjann, A., Roth, T., Millberg, J., Yun, H.: Real-Time Simulation of Camera Errors and Their Effect on Some Basic Robotic Vision Algorithms, Canadian Conference on Computer and Robot Vision (CRV 2013), 2013.

10. Hülsmann, M., Kopp, S., Huber, M., Reith, D.: Efficient Gradient and Hessian Computations for Numerical Optimization Algorithms Applied to Force Field Developments with Molecular Simulations, Journal of Physics Conference Series 02/2013, 2013.

11. Hülsmann, M., Kopp, S., Huber, M., Reith, D.: Utilization of Efficient Gradient and Hessian Computations in the Force Field Optimization Process of Molecular Simulations, Computational Science & Discovery, Num.1, 2013.

12. Hülsmann, M., Reith, D.: SpaGrOW - A Derivative-Free Optimization Scheme for Intermolecular Force field Parameters based on Sparse Grids Methods, Entropy 15, pp. 3640-3687, 2013.

13. Jendrosch, M., Dueck, G., Gracie, C., Hinkenjann, A.: PC Based Escape Analysis in the Java Virtual Machine, 5th International Conference on Software Technology and Engineering (ICSTE 2013), 2013.

14. Jendrosch, M., Dueck, G., Gracie, C., Hinkenjann, A.: PC Based Escape Analysis in the Java Virtual Machine, 10th UNB Research Exposition, Poster, 2013.

15. Kaul, M., Winzker, M., Grein, M.: Pro-MINT-us: Gezielte Förderung von MINT-Kompetenzen in der Studieneingangsphase, in: Philipp Pohlenz & Antje Oppermann (Ed.): "Exzellenz - Pakt - Lehre: 13. Jahrestagung des Arbeitskreises Evaluation und Qualitätssicherung", UVW Universitäts Verlag, pp. 111-117, 2013.

16. Kent, K.B., Hinkenjann, A., Neu, N.: Application performance improvements through VM parameter modification after runtime analysis, 10th UNB Research Exposition, Poster, 2013.

17. Koch, M., Schmidt, S., Herpers, R., Kent, K.B.: Improved Tree-Based Strategies for a Connect6 Threat-Based Hardware Design, IEEE Pacific Rim Conference on Communications Computers and Signal Processing (PACRIM 13), pp. 32-36, 2013.

18. Krämer-Fuhrmann, O., Neisius, J., Gehlen, N., Reith, D., Kirschner, K.: Wolf2pack - Portal Based Atomistic Force-Field Development, Journal Chem. Inf. Mod. 53, pp. 802–808, 2013.

19. Krueger, F., Seele, S., Herpers, R., Becker, P.: Dynamic Emotional States based on Personality Profiles for Adaptive Agent Behavior Patterns, Technical Report, University of Applied Sciences Bonn-Rhein-Sieg, Department of Computer Science, Vol. 2013 (2), 2013.

20. Kruijff, E.: Human-potential Driven Design of 3D User Interfaces, Proceedings of the IEEE International Conference on Artificial Reality and Telexistence (ICAT 2013), 2013.

21. Nasartschuk, K., Kent, K.B., Herpers, R.: Visual Exploration of Changing FPGA Architectures in the VTR Project, IEEE International Symposium on Rapid Systems Prototyping, Montreal, Canada, pp. 16-22, 2013.

22. Nasartschuk, K., Kent, K.B., Herpers, R.: Visual Exploration of Changing FPGA Architectures in the VTR Project, 10th UNB Research Exposition, Poster, 2013.

23. Rothe, I., Schwandt, A.: Using an Embroidery Machine to Achieve a Deeper Understanding of Electromechanical Applications, IEEE Frontiers in Education Conference (FIE 2013), 2013.

24. Samarin, P., Saitov, T., Herpers, R., Kent, K.B.: Data Traffic Reduction in Vision Applications using On-Board FPGA- based Image Preprocessing, 10th UNB Research Exposition, Poster, 2013.

25. Samarin, P., Saitov, T., Herpers, R., Kent, K.B.: Intensity and Distance Thresholding in Hardware to Enable Flexible Blob Detection for a Vision System with Limited Bandwidth, 4th International Symposium on Highly Efficient Accelerators and Reconfigurable Technologies (HEART 13), Edinburgh, Scotland, pp. 109-112, 2013.

26. Schuster, S.: System design of an auto-stereoscopic 3D multiview interaction system, Electronic Displays Conference - 1st place DFF Student Paper Award 2013, Poster, 2013.

27. Schwandt, A., Klein, B.: Development of an Evaluation Board for Education in Microcontrollers, IEEE Global Engineering Education Conference, 2013.

28. Sigitov, A., Hinkenjann, A., Roth, T.: Towards VR-based Systems for School Experiments, International Conference Virtual and Augmented Reality in Education (VARE 2013), 2013.

29. Sigitov, A., Roth, T., Mannuß, F., Hinkenjann, A.: DRiVE: An Example of Distributed Rendering in Virtual Environments, 6th Workshop on Software Engineering and Architectures for Realtime Interactive Systems (SEARIS 2013), 2013.

30. Vogt, T., Herpers, R., Strüder, H.K., Schneider, S.: Effects of Virtual Environments on Neuroelectric responses to Exercises, 9th Neuro Vision Congress, Cologne, Germany, 2013.

31. Weier, M., Hinkenjann, A., Demme, G., Slusallek, P.: Generating and Rendering Large Scale Tiled Plant Populations, JVRB - Journal of Virtual Reality and Broadcasting, Vol. 10, Num. 1, 2013.

32. Winzker, M., Schwandt, A., Krumkamp, T., Tieke, A.: Architecture and Implementation of a Development Board for Low-Power Education, IEEE International Symposium on Circuits and Systems (ISCAS 13), 2013.

33. Zotos, E., Herpers, R.: Distributed Rendering for Interactive Multi-screen Visualization Environments Based on XNA Game Studio, M.L. Gavrilova et al. (Eds.): Trans. on Comput. Sci. XVIII, Springer, LNCS 7848, pp. 1-20, 2013.

Publications

2014

1. Alexandrov, S., Herpers, R.: Evaluation of Recent Approaches to Visual Odometry from RGB-D Images, Proceedings of the 17th RoboCup 2013 International Symposium, Eindhoven, Springer, LNCS, pp. 444-455, 2014.

2. Fassbender, E., Heiden, W.: Atmosphaeres - 306° Video Environments for Stress and Pain Management, LNCS 8778, 48-58, 2014.

3. Harris, L.R., Herpers, R., Hofhammer, T., Jenkin, M.: How Much Gravity Is Needed to Establish the Perceptual Upright?, PLOS ONE, Vol. 9, 2014.

4. Harris, L.R., Herpers, R., Hofhammer, T., Noppe, A., Jenkin, M.: Is gravity on other planets adequate to provide self-orientation cues? 6th International Congress of Medicine in Space and Extreme Environments, ICMS 2014, Berlin, Germany, 2014.

5. Haubrich, T., Seele, S., Herpers, R., Becker, P., Bauckhage, C.: Synthetic Perception for Intelligent Virtual Agents, Proceedings of the first ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play, (CHI PLAY 14), ACM, pp. 421-422, 2014.

6. Haubrich, T., Seele, S., Herpers, R., Becker, P.: Integration of Road Network Logics into Virtual Environments, Conference of Virtual Reality (IEEE VR 14), Minneapolis, United States, pp. 79-80, 2014.

7. Haubrich, T., Seele, S., Herpers, R., Müller, M.E., Becker, P.: A Semantic Road Network Model for Traffic Simulations in Virtual Environments: Generation and Integration, 7th Workshop on Software Engineering and Architectures for Realtime Interactive Systems (SEARIS 14), 2014.

8. Heisenberg, G., Rezaei, Y. A., Rothdeutsch, T., Heiden, W.: Arm Prosthesis Simulation on a Virtual Reality L-shaped Workbench Display System using a Brain Computer Interface, 10th International Conference Disability, VR & Associated Technologies, Gothenburg, Sweden, pp. 109-117, 2014.

9. Jato, O., Hinkenjann, A.: Memory Management for Interactive Rendering of Large and Semitransparent Volumes, GPU Technology Conference (GTC 14), Poster, 2014.

10. Kishishita, N., Kiyokawa, K., Kruijff, K., Orlosky, J., Mashita, T., Takemura, H.: Analysing the Effects of a Wide Field of View Augmented Reality Display on Search Performance in Divided Attention Tasks, In Proceedings of the IEEE and ACM International Symposium on Mixed and Augmented Reality (ISMAR 14), 2014.

11. Krüger, F., Seele, S., Herpers, R., Bauckhage, C., Becker, P.: Dynamic Emotional States Based on Personality Profiles for Adaptive Agent Behavior Patterns, 11th Workshop Virtuelle Realität und Augmented Reality der GI-Fachgruppe VR/AR, Ed. G. Zachmann et al., Shaker Verlag, pp. 73-84, 2014.

12. Krüger, F., Seele, S., Herpers, R., Becker, P., Bauckhage, C.: Adaptive Decision Making in Microsimulations of Urban Traffic in Virtual Environments, International Conference on Entertainment Computing (ICEC 14), Y. Pisan et al. (Eds.), LNCS 8770, pp. 220-222, 2014.

13. Kruijff, E.: 3DUI design inspired by Assistive Technology, 2nd International Workshop on Virtual and Augmented Assistive Technology (VAAT) at IEEE Virtual Reality, 2014.

14. Li, J., Nasartschuk, K., Kent, K.B.: System-on-Chip Processor using Different FPGA Architectures in the VTR CAD Flow, IEEE International Symposium on Rapid Systems Prototyping, New Delhi, India, pp. 72-77, 2014.

15. Luu, J., Goeders, J., Yu, T., Liu, T., Wainberg, M., Somerville, A., Nasartschuk, K., Wang, S., Nasr, M., Ahmed, N., Kent, K.B., Anderson, J., Rose, J., Betz, V.: VTR 7.0: Next Generation Architecture and CAD System for FPGAs, ACM Transactions on Reconfigurable Technology and Systems, Vol. 7, issue 2, pp. 1-30, June 2014.

16. Luu, J., Huda, S., Chiasson, C., McCullough, C., Wang, S., Kent, K.B., Anderson, J., Rose, J., Betz, V.: On Hard Adders and Carry Chains in FPGAs, Field Programmable Custom Computing Machines Symposium, Boston, USA, 2014.

17. Neu, N., Kent, K.B., Gracie, C., Hinkenjann, A.: Automatic Application Performance Improvements through VM Parameter Modification after Runtime Behavior Analysis, 8th International Conference on Performance Evaluation Methodologies and Tools, Bratislava, Slovakia, 2014.

18. Rezaei, Y.A., Heisenberg, G., Heiden, W.: User Interface Design for Disabled People Under the Influence of Time, Efficiency and Costs, HCI International 2014, Heraklion, Greece, pp.197-202, 2014.

19. Scherfgen, D., Herpers, R.: Camera-Based 3D Pointing Technique Using Dynamic On-Screen Markers, 11th Workshop Virtuelle Realität und Augmented Reality der GI-Fachgruppe VR/AR, Ed. G. Zachmann et al., Shaker Verlag, pp. 133-144, 2014.

20. Wang, Y., Hu, M., Kent, K.B.: ACS: An Effective Admission Control Scheme with Deadlock Resolutions for Workflow Scheduling in Clouds, Springer Computing Journal, pp. 1-24, May 2014.

21. Wang, Y., Johnson, G., Kent, K.B.: Improving J9 Virtual Machine with LTTing for Efficient and Effective Tracing, Software: Practice and Experience pp. 1-15, 2014.

22. Wang, Y., Lu, P., Kent, K.B.: WaFS: A Workflow-Aware File System for Effective Storage Utilization in Clouds, IEEE Transactions on Computers, issue 99, pp. 1-14, Nov. 2014.

23. Weier, M., Maiero, J., Roth, T., Hinkenjann, A., Slusallek, P.: Enhancing Rendering Performance with View-Direction-Based Rendering Techniques for Large, High Resolution Multi-Display Systems, 11th Workshop Virtuelle Realität und Augmented Reality der GI-Fachgruppe VR/AR, 2014.

24. Weier, M., Maiero, J., Roth, T., Hinkenjann, A., Slusallek, P.: Lazy Details for Large High-Resolution Displays, SIGGRAPH ASIA, Poster, 2014.

25. Winzker, M.: Addressing Low-Power Electronics in a Digital System and FPGA Design Course, IEEE Global Engineering Education Conference, 2014. (EDUCON 14), pp. 69-73, 2014.

26. Zachmann, G., Weller, R., Hinkenjann, A.: Virtuelle und Erweiterte Realität, 11th Workshop der GI-Fachgruppe VR/AR, Shaker Verlag, 2014.

27. Zeng, L., Xu, S., Wang, Y., Kiat, T.W., Cui, X., Bremner D., Kent, K.B.: A Monetary-Aware Replica Placement in Cloud Environments, 6th IEEE International Conference on Cloud Computing Technology and Science, Singapore, 2014.

Bachelor and Master Theses

Bachelor Theses

2013

Marc Bobowk, Entwicklung eines Autorensystems für die Hypermedia Novel als Rich Internet Application.
Supervised by Prof. Dr. Wolfgang Heiden.

Michael Dicke, Efficient monocular SLAM for UAV navigation.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Benedict Endemann, Serverseitige Komposition von Video- und Bilddaten anhand einer Timelinedatei.
Supervised by Prof. Dr. Wolfgang Heiden.

Peter Flock, Analyse von ToF Videobilddaten zur Unterstützung von Sehbehinderten bei der Hinderniserkennung.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Philipp Frericks, Implementierung eines bidirektionalen Path Tracers auf GPUs.
Supervised by Prof. Dr. André Hinkenjann.

Thorsten Hümpel, Registrierung von Stereobildern unterschiedlicher Bildintensität.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Yasin Ilkbahar, HTML5 und Javascript - Elemente und Technologien als Grundlage für HTML5-Apps.
Supervised by Prof. Dr. Wolfgang Heiden.

Pascal Jakobs, Natürliche Interaktion und Navigation bei virtuellen Industrieanlangen.
Supervised by Prof. Dr. André Hinkenjann.

Marc Klein, Entwicklung einer plattformunabhängigen Terminplaner-App für Mobile Endgeräte.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Marco Koppenol, Entwicklung einer virtuellen Umgebung zur Planung und Visualisierung der Innenarchitektur eines Schiffes.
Supervised by Prof. Dr. André Hinkenjann.

Daniel Müller, Charakterisierung von dezentralen sozialen Netzwerken und Konzeption mit prototypischer Implementierung eines Anwendungsszenarios.
Supervised by Prof. Dr. Wolfgang Heiden.

Daniel Schüller, Analyse verschiedener plattformübergreifender Datenübertagungs-Möglichkeiten zum Import/Export von Statusinformationen einer Hypermedia Novel.
Supervised by Prof. Dr. Wolfgang Heiden.

Enrico Werner, Analyse und Entwicklung eines Datenmodells zu impedanzspektroskopischen Messungen.
Supervised by Prof. Dr. Wolfgang Heiden.

Florian Wurth, Gemessene BRDFs in interaktiven, grafischen Anwendungen.
Supervised by Prof. Dr. André Hinkenjann.

Thomas Zellhahn, Entwicklung einer 3D CNC-Drehmaschinen-Simulation mit interaktiver Steuerung.
Supervised by Prof. Dr. André Hinkenjann.

2014

Eduard Assenheimer, Analyse, Design und Entwicklung eines taktilen Feedback Gerätes für Virtual Reality Umgebungen.
Supervised by Prof. Dr. André Hinkenjann.

Daniel Dam, Konzeption und Entwicklung webbasierter und interaktiver Visualisierungskomponenten für Honeypot-Daten.
Supervised by Prof. Dr. Wolfgang Heiden.

Tobias Hagemann, Analyse, Implementierung und Evaluation einer Handschriftverschönerung durch digitale Eingabe.
Supervised by Prof. Dr. Wolfgang Heiden.

Marcus Held, Evaluation binär codierter Serialisierungsformate im Vergleich mit JSON am Projekt Goodgame Empire.
Supervised by Prof. Dr. Wolfgang Heiden.

Giovanni Maccaferri, Analyse von EEG-Zeitreihen zur Unterscheidung verschiedener Vigilanzzustände für eine sichere Erkennung von Pre-Fatiguephasen.
Supervised by Prof. Dr. Wolfgang Heiden.

Alexander Marquardt, Multisensorisches Feedback in interakiven Umgebungen.
Supervised by Prof. Dr. André Hinkenjann.

Lukas Pink, Java Implementation eines Umgebungsmodells für Sonardaten.
Supervised by Prof. Dr. André Hinkenjann.

Timo Rothdeutsch, Entwicklung einer rückprojektionsbasierten virtuellen Umgebung zur Armprothesensimulation.
Supervised by Prof. Dr. Wolfgang Heiden.

Gennady Solomennikov, Visualisierung multidimensionaler Datenvektoren aus zeitvarianten Lichtmessungen.
Supervised by Prof. Dr. André Hinkenjann.

Bachelor Theses

2013

Sergey Alexandrov, Geometric Segmentation of Point Cloud Data by Spectral Analysis.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Thomas Dettmar, Microscopic Traffic Simulation for Virtual Environments based on Queuing Models.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Marcel Dombrowski, Dynamic Monitor Allocation in the IBM J9 Virtual Machine.
Supervised by Prof. Dr. Kenneth Kent and Prof. Dr.-Ing. Rainer Herpers.

Oliver Jato, Rendering Large Volume Datasets with CUDA.
Supervised by Prof. Dr. André Hinkenjann.

Manfred Jendrosch, Runtime Escape Analysis in a Java Virtual Machine.
Supervised by Prof. Dr. André Hinkenjann.

Shahmi Junoh, Vision-based Target Detection and Pose Estimation for Tilt-Wing MAV Automatic Landing.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Tobias Krumkamp, Systementwurf zur Verlustleistungsanalyse der Videosignalverarbeitung im FPGA.
Supervised by Prof. Dr.-Ing. Marco Winzker.

Fabian Krüger, Realistischere Mikrosimulation des Straßenverkehrs in virtuellen Umgebungen durch Einbeziehen von Persönlichkeitsprofilen.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Konstantin Nasartschuk, Visualization Support for FPGA Architecture Exploration.
Supervised by Prof. Dr. Kenneth Kent and Prof. Dr.-Ing. Rainer Herpers.

Peter Samarin, Using Fiducial Markers for Precise Camera Pose Calculation on FPGAs.
Supervised by Prof. Dr. Kenneth Kent and Prof. Dr.-Ing. Rainer Herpers.

Jochen Schreiber, Automatische Klassifikation von Hits eines uHTS-Screens unter Berücksichtigung von verschiedenen Features.
Supervised by Prof. Dr. Wolfgang Heiden.

Shima Shahi Irani, Car License Plate Recognition.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Vanesa Vattakuzhiyil, Mobile Learning in der beruflichen Weiterbildung am Beispiel des Beschaffungsprozesses.
Supervised by Prof. Dr. Wolfgang Heiden.

Daniel Weigelt, Entwicklung einer mobilen Applikation unter Verwendung von Computer Vision Algorithmen im Bereich Objekt- und Fahrspurerkennung zur Navigation eines autonomen Fahrzeugs.
Supervised by Prof. Dr. André Hinkenjann.

Master Theses

Master Theses

2014

Tobias Haubrich, Entwicklung eines synthetischen Perzeptionsprozesses für intelligente virtuelle Agenten.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Steffen Kampmann, Inference based Model Analysis for Traffic Simulations in Virtual Environments.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Antony Konstantinidis, Digitalisierung eines Pen-&-Paper-Rollenspiels mit Übertragung von Interaktionen in die reale Welt.
Supervised by Prof. Dr. Wolfgang Heiden.

Nicolas Kopp, Digitalisierung eines Pen-&-Paper-Rollenspiels mit Übertragung von Interaktionen in die reale Welt.
Supervised by Prof. Dr. Wolfgang Heiden.

Jingjing Li, Investigating FPGA Architectures for System-on-Chip.
Supervised by Prof. Dr. Kenneth Kent.

Nicolas Neu, Automatic Application Performance Improvements through VM Parameter Modification after Runtime Behavior Analysis.
Supervised by Prof. Dr. Kenneth Kent and Prof. Dr. André Hinkenjann.

David Scherfgen, Camera-Based 3D Pointing Approach Using Dynamic On-Screen Markers.
Supervised by Prof. Dr.-Ing. Rainer Herpers.

Sven Schmidt, Interaktive Clusteranalyse von statistischen Datenfeldern mit Hilfe von 3D-Visualisierung.
Supervised by Prof. Dr. Wolfgang Heiden.

Nicolas Simon, Entwicklung von Schnittstellen für die Bedienung von Kommunikation- und Entertainment-Anwendungen durch motorisch und sprachlich stark eingeschränkte Benutzer.
Supervised by Prof. Dr. Wolfgang Heiden.

Adnan Touati, Segmentierung, Detektion und Verfolgung von Objekten mittels RGB-D Kamera und deren Augmentierung anhand einer Projektion.
Supervised by Prof. Dr. André Hinkenjann.

Bo Yan, High-Level Synthesis Improvements and Optimizations in Odin-II.
Supervised by: Prof. Dr. Kenneth Kent.

2013

- IEEE Pacific Rim Conference on Communications, Computers and Signal Processing
- IEEE International Workshop on Highly Efficient Architectures and Reconfigurable Technologies
- IEEE International Symposium on Rapid System Prototyping
- IEEE International Conference on Field Programmable Logic and Applications
- Euromicro Conference on Digital System Design
- IEEE 11th International Conference on Embedded and Ubiquitous Computing
- International Conference on Advances in Circuits, Electronics and Micro-electronics
- IEEE Symposium on 3D User Interfaces
- IEEE International Symposium on Mixed and Augmented Reality
- ACM ACM Conference on Human Factors in Computing Systems (CHI)
- Workshop der Fachgruppe GI VR/AR, September 2013, Würzburg
- IEEE Engineering Education Conference, EDUCON 2013
- IEEE Frontiers in Education 2013
- IEEE International Conference on Teaching, Assessment, and Learning for Engineering, TALE 2013
- JVRB Journal of Virtual Reality and Broadcasting
- ISVC International Symposium on Visual Computing, Rethymnon, Crete, Greece
- XV Symposium on Virtual and Augmented Reality, SVR 2013

2014

- IEEE International Workshop on Highly Efficient Architectures and Reconfigurable Technologies
- IEEE International Symposium on Rapid System Prototyping
- IEEE International Conference on Field Programmable Logic and Applications
- IEEE International Conference on Field Programmable Technology
- Euromicro Conference on Digital System Design
- IEEE International Conference on Embedded and Ubiquitous Computing
- International Conference on Advances in Circuits, Electronics and Micro-electronics
- JVRB Journal of Virtual Reality and Broadcasting
- IEEE Virtual Reality Conference, Minneapolis, USA
- ISVC International Symposium on Visual Computing, Las Vegas, USA
- XVI Symposium on Virtual and Augmented Reality (SVR 2014)
- Zeitschrift für Hochschulentwicklung, ZFHE
- 11. Workshop der Fachgruppe GI VR/AR, September 2014, Bremen
- IEEE Engineering Education Conference, EDUCON 2014
- IEEE Frontiers in Education 2014
- IEEE International Conference on Teaching, Assessment, and Learning for Engineering, TALE 2014
- ICED'14, 2nd International Conference on Electronic Design
- IEEE Symposium on Industrial Electronics & Applications, ISIEA 2014
- IEEE Symposium on 3D User Interfaces
- IEEE International Symposium on Mixed and Augmented Reality

VC Colloquia

2013

Dr. Barbara Krausz,
Fraunhofer IAIS, Birlinghoven, Germany,

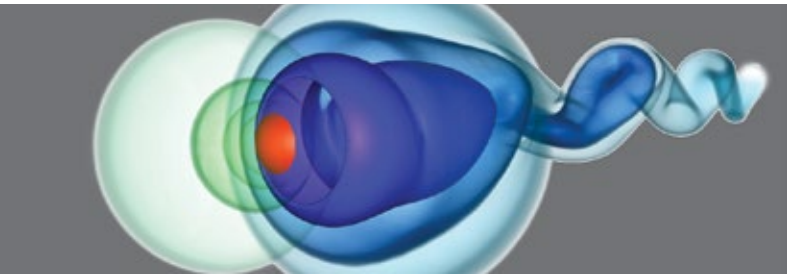
Detection of Dangerous Human Crowd Behavior,

10 January 2013

Prof. Dr. J. Edward Swan II,
Mississippi State University, USA,

Perception in Augmented Reality,

01 July 2013



Prof. Dr. Greg Welch,
University of Central Florida, USA,

Physical-Virtual Humans for Training and Teleportation,

20 September 2013

Prof. Dr. Dr. h.c. Thomas Ertl,
University of Stuttgart, Germany,

Interaktive Visualisierung –
Wege aus der Datenflut,
04 June 2013

M.Sc. Marcel Dombrowski, Prof. Dr. Kenneth Kent,
University of New Brunswick, Canada,

Dynamic Monitor Allocation in the Java Virtual Machine,

11 October 2013

Prof. Henry Fuchs,
University of North Carolina at Chapel Hill, USA,

Dreams, Illusions, and Promise of Telepresence,

17 June 2013

Prof. Dr. Daniel Keim,
University of Konstanz, Germany,

Solving Problems with Visual Analytics:
Challenges and Applications,
14 November 2013

Prof. Dr.-Ing. Stephan Olbrich,
University of Hamburg, Germany,

Scalable In-Situ Data Extraction
and Distributed Visualization,
10 December 2013

Dr. Mark Mine,
Walt Disney Imagineering,

Technology and Magic at
Walt Disney Imagineering,
18 June 2013

Prof. Dr. Kiyoshi Kiyokawa,
University of Osaka, Japan,

Trends and Visions of Head Mounted Display Technologies,
25 June 2014

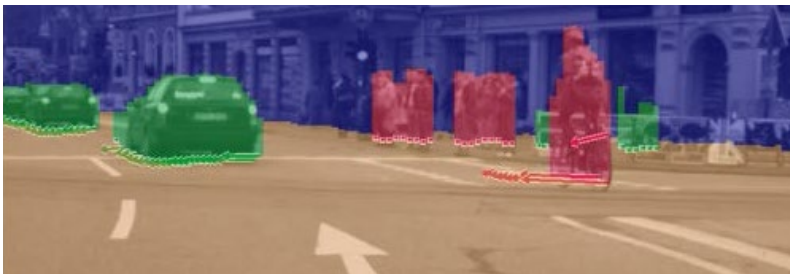
Prof. Michael Jenkin,
York University, Toronto, Canada

Talking with Robots: Experiences and Some Lessons Learned,
10 September 2014

2014

Prof. Dr. Oliver Deussen,
University of Konstanz, Germany,

Non-Photorealistic Rendering Methods and Their Application,
12 May 2014



Dr. Markus Enzweiler,
Daimler AG Research & Development Environment Perception in Sindelfingen, Germany,

Computer Vision for Autonomous Driving,
14 October 2014

Prof. Dr. Stephan G. Lukosch,
University of Delft, Netherlands,

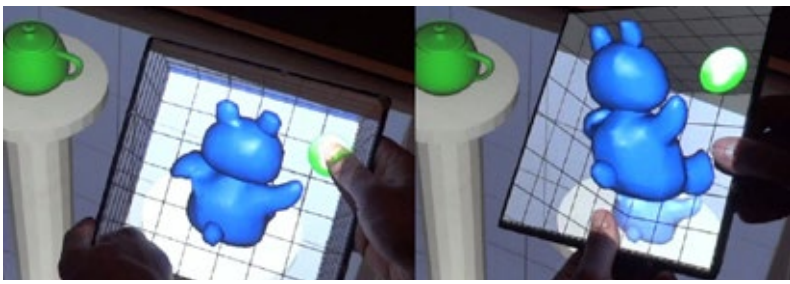
Virtual Co-Location: As If Being There?,

30 October 2014

Prof. Robert Allison,
York University, Toronto, Canada,

Scale in Stereoscopic 3D Media,

10 June 2014



Prof. Dr. Frank Steinicke,
University of Hamburg, Germany,

Perceptually-Inspired Interfaces for the Ultimate Display,

12 June 2014

Prof. Dr. Raimund Dachselt,
University of Dresden, Germany,

Natural Interaction in Multi-Display Environments,

11 December 2014


Messe Stuttgart
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Messe Stuttgart

Industry Workshop 2013 at IVC,
Sankt Augustin,
20 February 2013

IVAB Project at "Hannover Messe 2013",
Hannover,
8-12 April 2013

Fivis Project at "Tag der Technik 2013"
(Technology Day 2013), Düsseldorf,
14-15 June 2013

Emotiv EPOC Project on TV in "PLANETOPIA – Das Wissensmagazin: Das Ende des Passworts – Was folgt auf Zahlen und Buchstaben?" (Popular science show: The End of the Password - What Comes After Digits and Letters?) with Markus Appelmann, SAT.1,
7 October 2013

SimuBridge Project at "Didacta 2014 die Bildungsmesse"
(Education Trade Fair 2014), Stuttgart,
25-29 March 2014

OLIVE Project on TV in "Lokalzeit Südwestfalen" (Local Magazine South Westphalia), WDR,
1 September 2014

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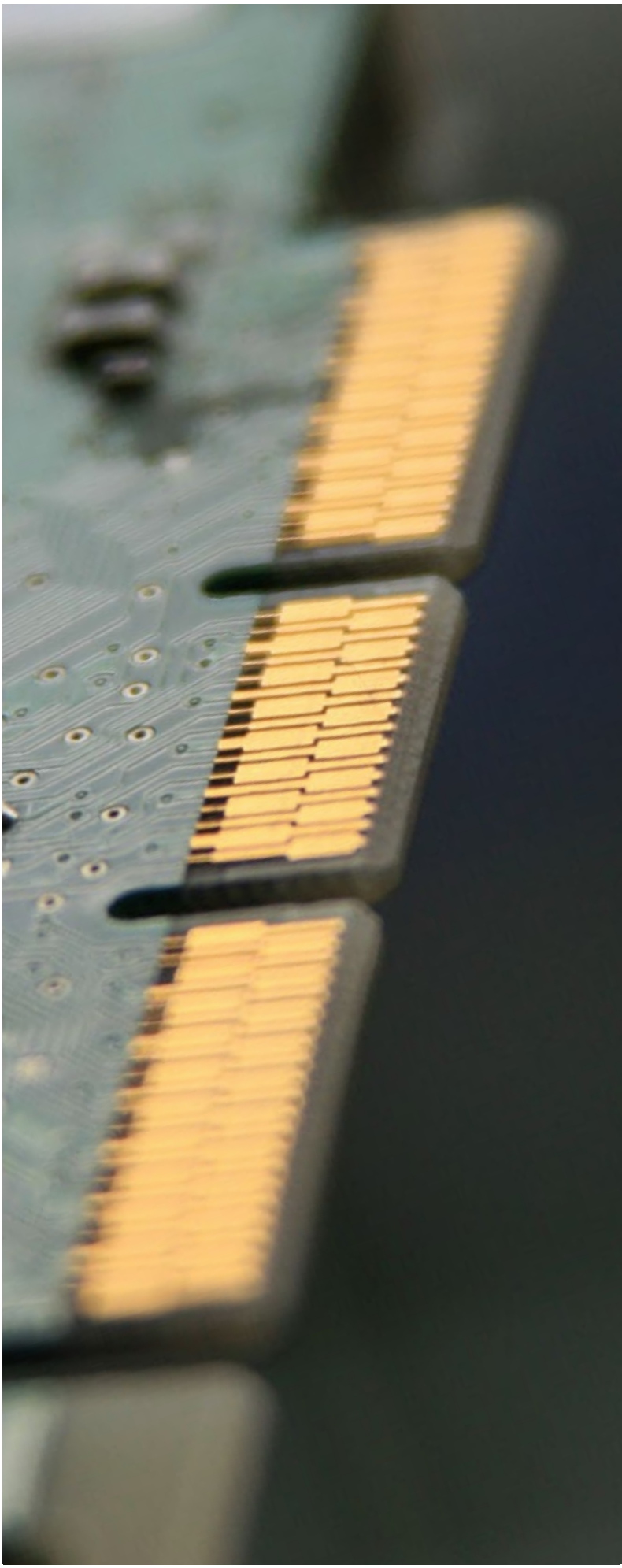

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